POPULAR SCIENCE

MONTHLY

MECHANICS - AUTOS - HOMEBUILDING

35¢ April

8-Ball Tests New Bug Killers

PAGE 114

PAGE 106

Nash's New Economy Car

Ford's New Sports Car

PAGE 102

GIVE YOUR HOUSE THAT DREAM HOME LOOK

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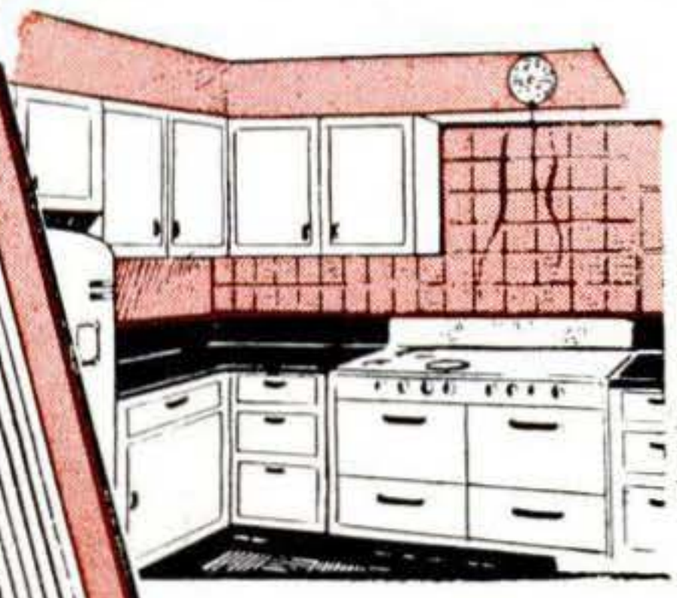
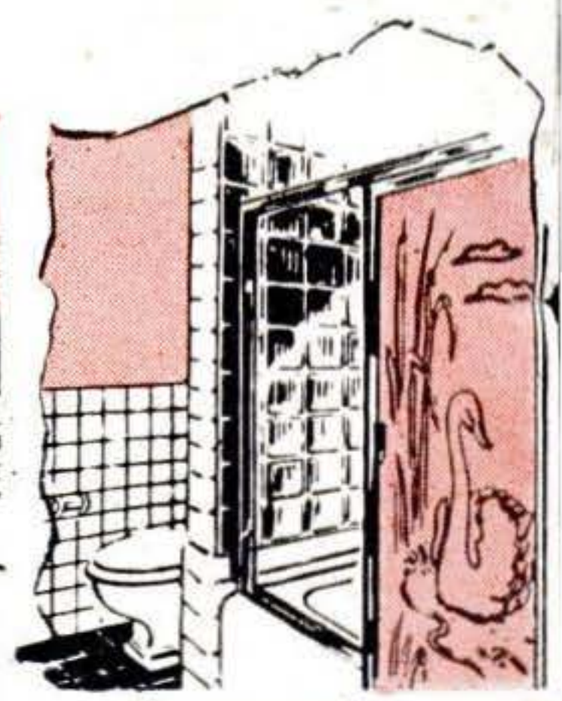
Hubbard Cobb



You'll be the hero of the hour when you build this Streamlined Kitchen every woman dreams about, with the help of this book!



You can easily grace your home with a modern, stunning Hollywood Bath!

MORE THAN 1,000 "How-to-Do-It" Pictures!
(Charts, Tables, Sketches, etc.)
300,000 Words, 512 Pages of Room-by-Room Ideas
by Famous "Handyman" Hubbard Cobb

Ideas on using glass blocks to give rooms glamor, better lighting!

9 Almost Like Having Books in ONE!

1. Concrete, Masonry, Bricks, Glass
2. Rough Carpentry, Houses, Rooms
3. Millwork, Windows, Doors, Screens, Floors
4. Roofs, Insulation, Ventilation, Heating
5. Interior Finish, Plaster, Linoleum, Tile, Flooring
6. Plumbing, Heating, Fireplaces, Chimneys
7. Tools, Hardware for Your EVERY Need
8. Paints, Varnishes, Sprayers, Brushes
9. Electrical Wiring, Fixtures

and Many Other Features!

Here Is a Mere Glimpse of Immense List of Contents:

1001 Money-Saving Ideas on EVERY Phase of Home Improvement Show How YOU Can Have the Luxury Home You've Longed for!

CONCRETE MASONRY, GLASS, BRICKS

Shower Stall Water-proofing
Correcting Sagging Wall
Glass Block Doorways, Walls
Concrete-Pouring Methods, Tools
Wood Frames,

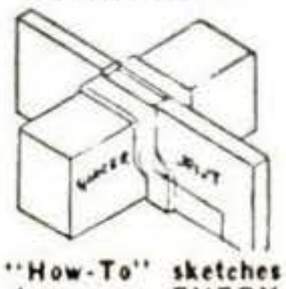
Cap Flashing, shown here, is one of hundreds of

Brick Veneer
Arches, Doorways, Partitions
Patterns in Bricklaying
Concrete Masonry Walls
Brick Facing
Concrete Steps

CARPENTRY

Lumber—Standard Measurements
Lumber Defects—How to Recognize
Roof, Nailing
Wall Bracing
Partitions, Wood
Plywoods, Fences
Stairs, Outdoor, Cellar
Kitchens—Blocks
Closets—Hinges
Hall Bench In

Woods for Exterior Trim
Woods for Porches
Woods for Interior Trim
Woods for Siding
Rafters, Layout Terms
Repairing Interior Walls
Terrace, Porch Construction



"How-To" sketches show you EVERY type of joist you'll ever need!

MILLWORK, WINDOWS, DOORS, SCREENS, FLOORS

Floors—Nailing, Laying, Finishing
Edgings, Doorways
Storm Windows, Doors
Shelves, Cabinets
Adjusting Doors
Built-In Furniture
Bathroom Cabinets

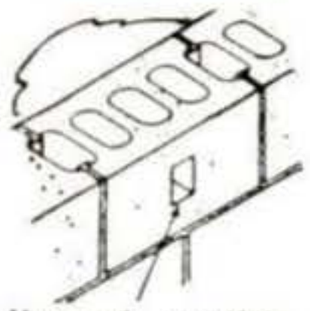
Joining Roof to Walls

ROOFS, INSULATION, VENTILATION, FLASHING

Installing Flashing—Diagrams, Instructions, Valleys, Chimneys, Hips, Windows, Doorways, etc.
Types of Insulation
Insulating Farm Buildings
Types of Shingles, Walls, Roofs, Hips, Ridges, etc.
How-To, How-Not-To Ideas
Tips on Repairing, Replacing
Leaks in Old Roofs
Roofing, Instructions

PLASTER, LINOLEUM, TILE

Tileboards
Repairing Walls
Tile-Laying Tips
Wall Plaster Mixing
Exterior and Interior Walls
Door, Window Openings, Trims



You get countless wiring facts such as installing outlets, even in concrete!

Linoleum Laying
Lifetime Wall Coverings
Repairing Ceilings
Installing New Ceilings
Making Rooms Seem Larger, Wider
Installing Ceiling Panels

HEATING, PLUMBING, CHIMNEYS

Building Fireplaces
Plumbing, Pipes of All Kinds
Faucet Installations
Coal Bins, Construction
Fixtures, Tubs, Sinks, Showers

Chimney Construction
Hot Water Systems
Making Woods Fire-Resistant

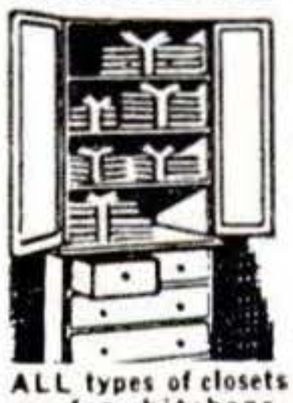
PAINTS, VARNISHES

Tinting
Cleaning Paint Spots
Floor Sealers
Decorating Old Floors
Color, Decorating Tips
Types of Finish—When, Where, How to Use
Whitewashing, Ingredients
Painting Wood Floors
Paints for Brick, Concrete, Plaster

TOOLS, NAILS, HARDWARE

Scaffolds
Ladders, Use and Precautions
Sliding Windows
Latches
Screens—Repairing, Replacing, Construction, Painting, Installation
Bolts, Screws, Nails—All types and Sizes

Individual Room Heating
Thermostats
Kitchen Outlets
Bells, Chimes
Lamps, Types, Best Placing
Low-Voltage Wiring
Approved Labels



ALL types of closets — for kitchens, bathrooms, bedrooms, etc.

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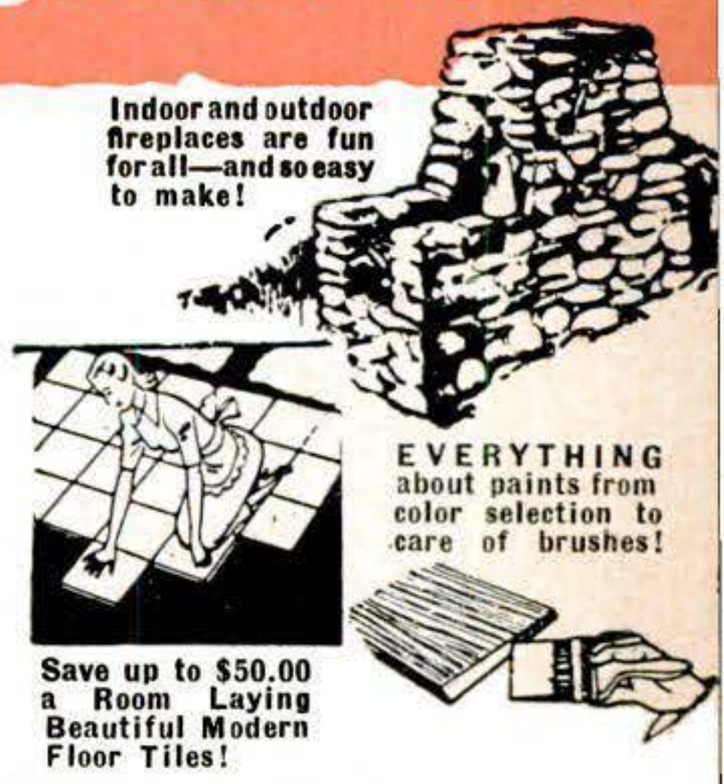

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POPULAR SCIENCE

REG. U. S. PAT. OFF. *Monthly*

Mechanics and Handicraft
REG. U. S. PAT. OFF.

April, 1954

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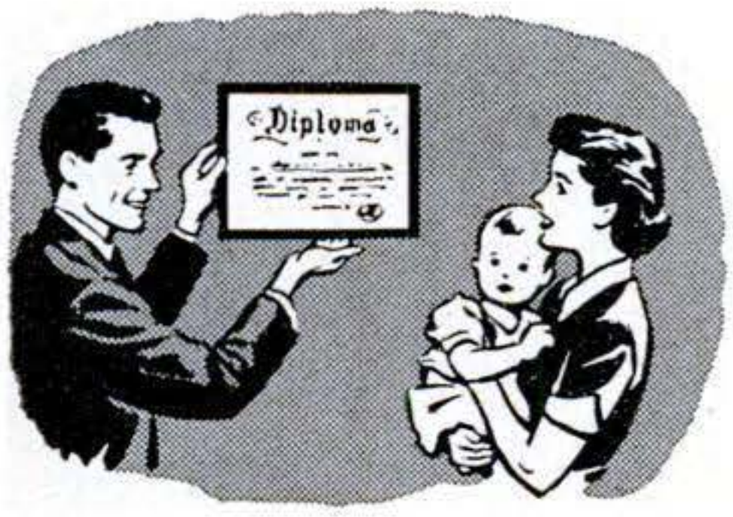

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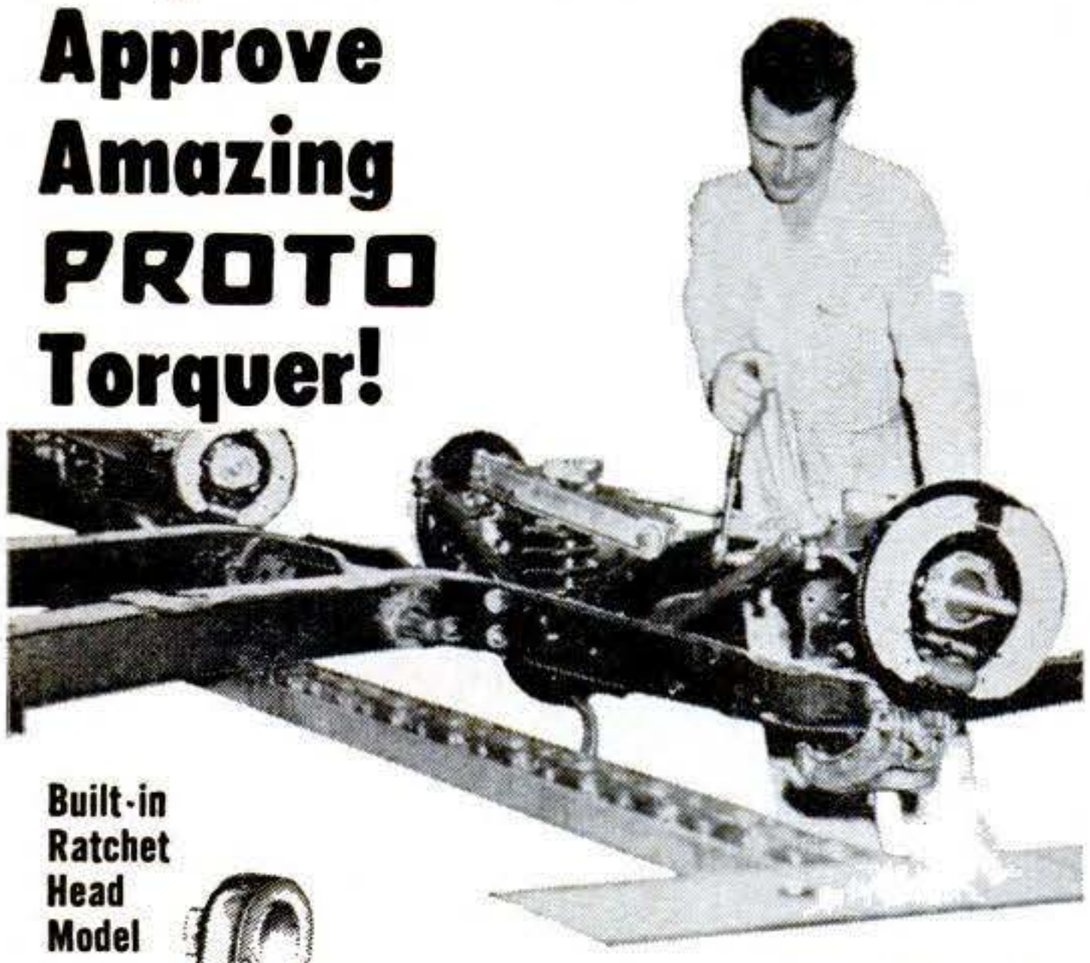

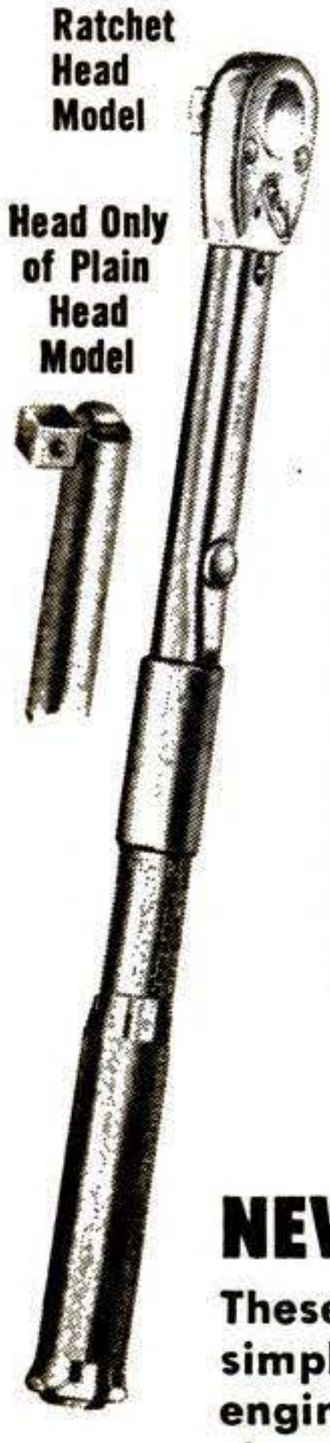

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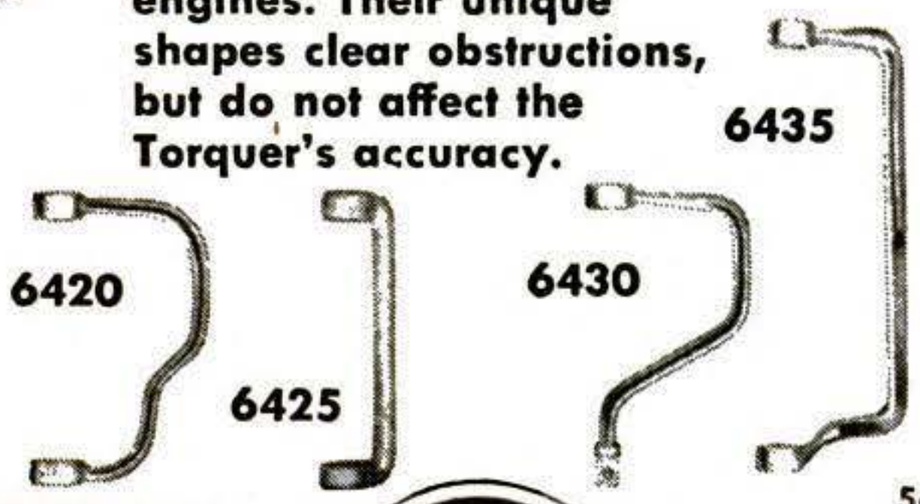

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The Story Behind the Picture

Bill (W.W.) Morris, the man with the flying coattails in the photo above, shot the vivid color picture of the new baby Nash on this month's cover.

He found it the knottiest assignment he's had since he founded PSM's photographic department 13 years ago. For five wintry days, Morris, two men from Nash Motors, four men from TWA and our Midwestern Editor tried to bring the Nash, the big cargo plane, the two lift trucks and Chicago's elusive January sunlight together at one time. On the fifth day, during a tingling half hour when practically everybody held his breath, the trick was turned and Bill's shutter clicked.

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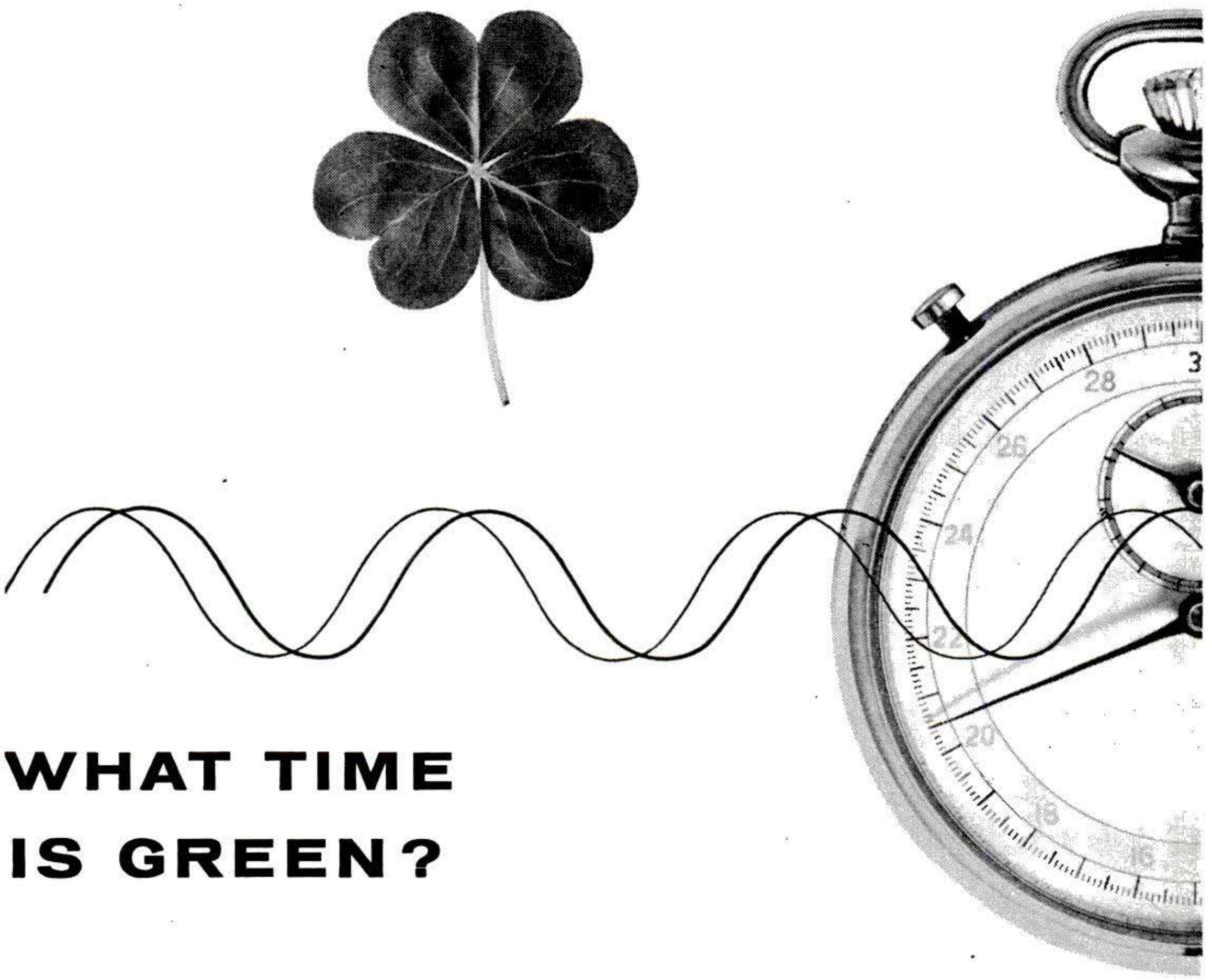

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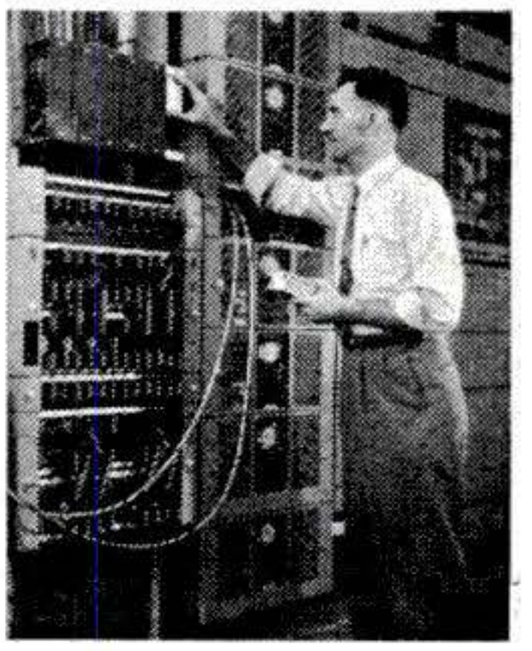
In color television, the colors on the screen are determined in a special way. A reference signal is sent and then the color signals are matched against it. For example, when the second signal is out of step by 50-billionths of a second, the color is green; 130-billionths means blue.

For colors to be true, the timing must be exact. An error of unbelievably small size can throw the entire picture off color. A delay of only a few billionths of a second can make a yellow dress appear green or a pale complexion look red.

To ready the Bell System's television network for color transmission, scientists at Bell Telephone Laboratories developed equipment to measure wave delay to one-billionth of a second. If the waves are off, as they wing their way across the country, they are corrected by equalizers placed at key points on the circuit.

This important contribution to color television is another example of the pioneer work done by Bell Telephone Laboratories to give America the finest communications in the world.



To keep colors true in television, signals must be kept on one of the world's strictest timetables. Equalizers that correct off-schedule waves are put into place at main repeater stations of the transcontinental radio-relay system.

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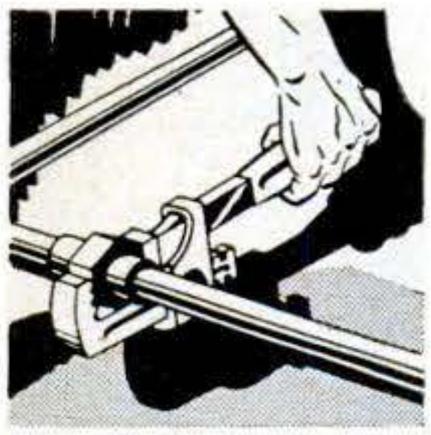

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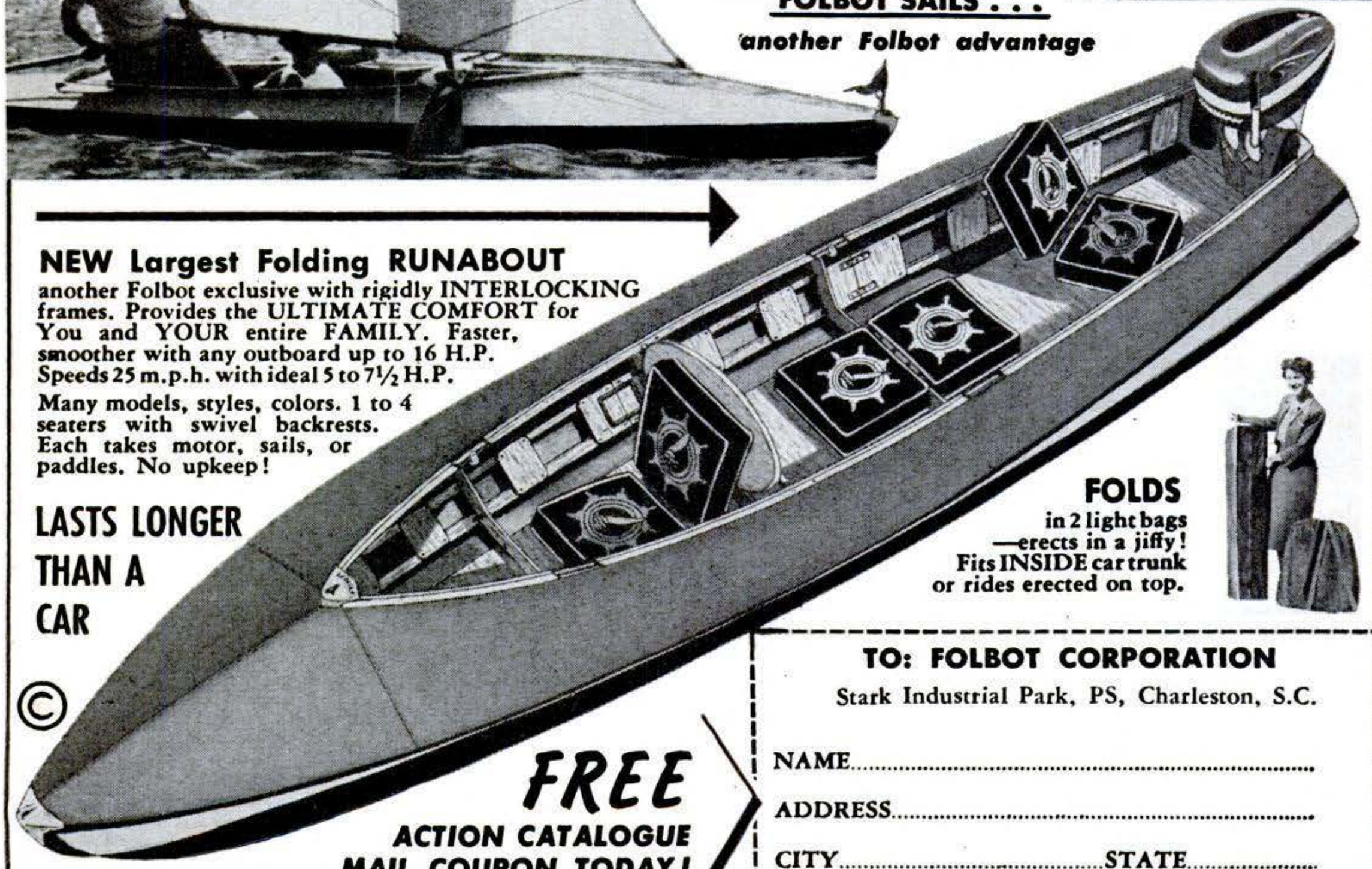

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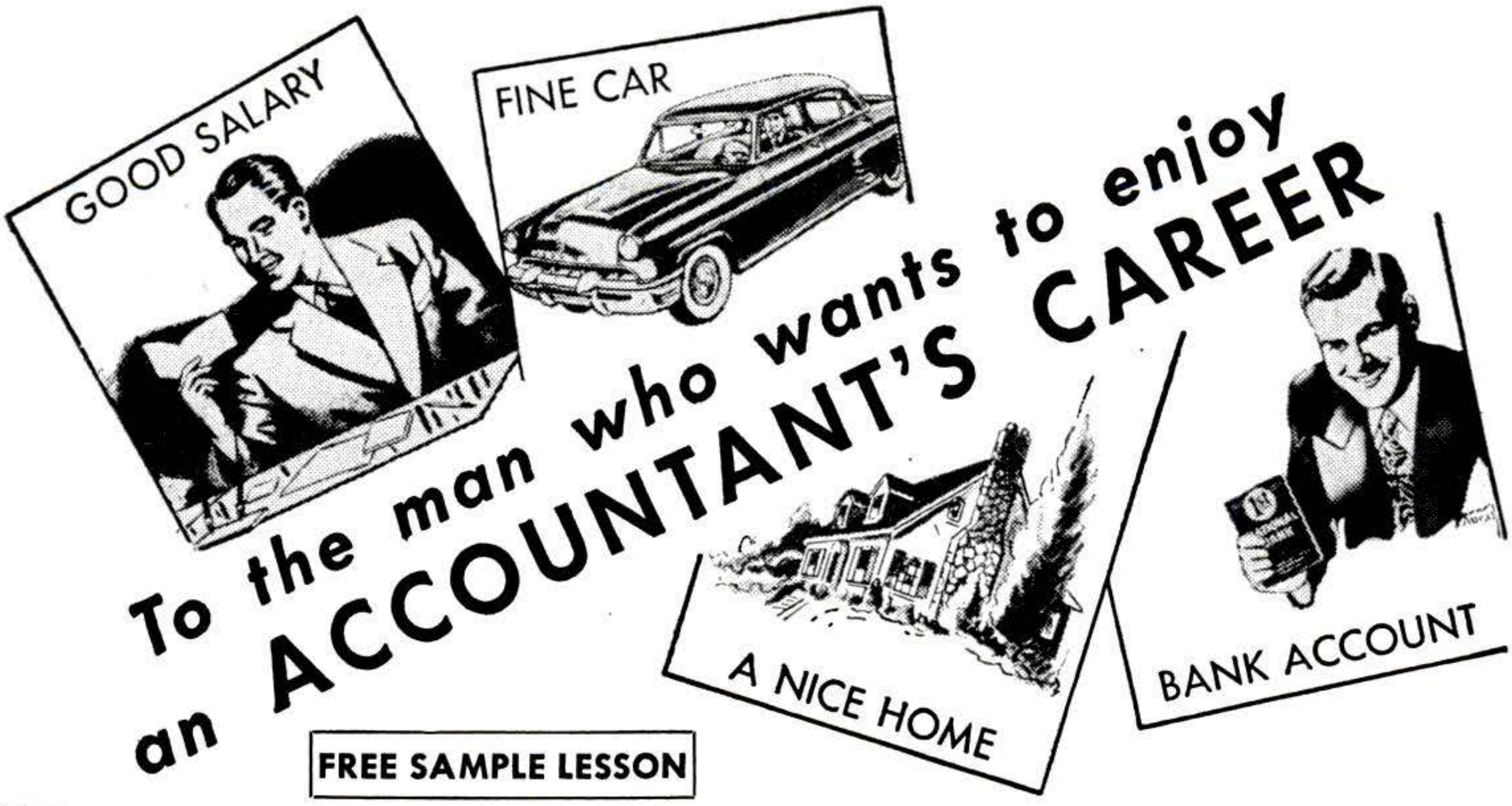

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IF you're that man, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn't it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period? Always provided that the rewards were good—a salary of $4,000 to $10,000?

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Why not, like so many before you, investigate LaSalle's modern Problem Method of training for an accountancy position?

Just suppose you were permitted to work in a large accounting house under the personal supervision of an expert accountant. Suppose, with his aid, you studied accounting principles and solved problems day by day—easy ones at first—then more difficult ones. If you could do this—and could turn to him for advice as the problems became complex — soon you'd master them all.

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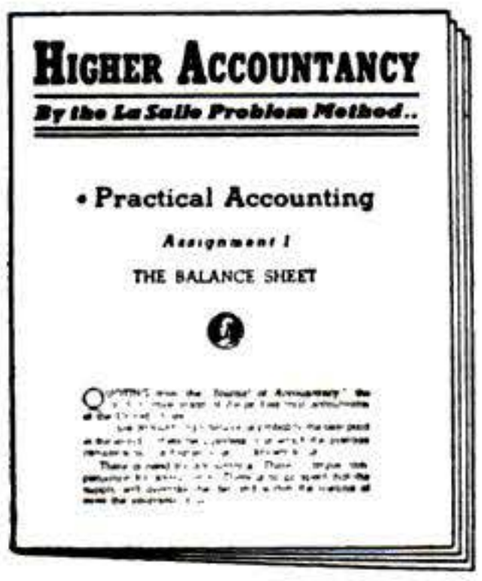

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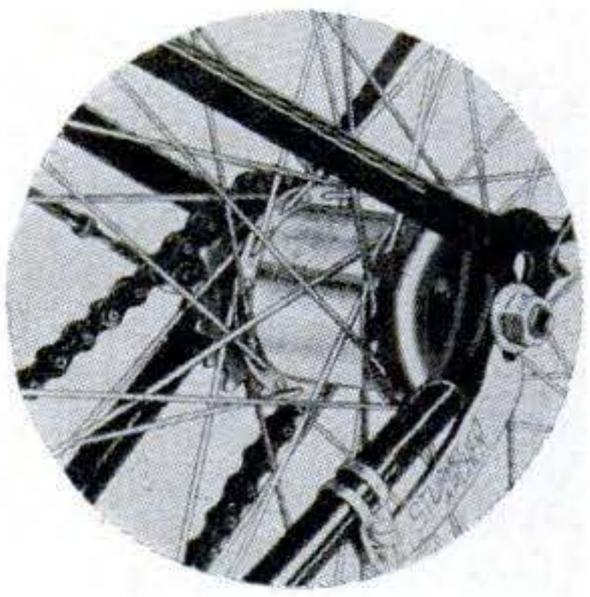

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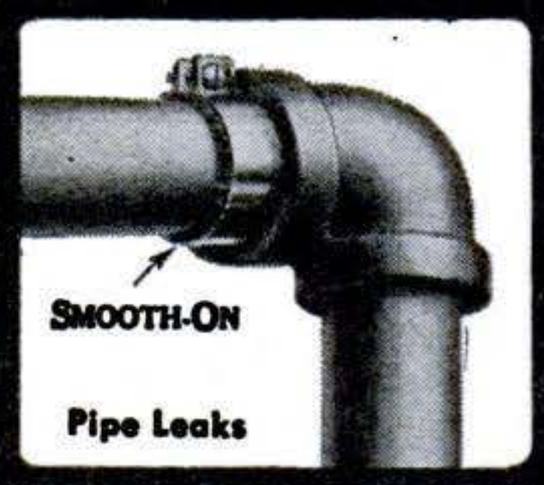
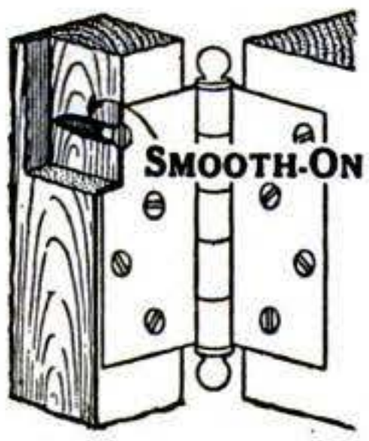


Pipe Leaks



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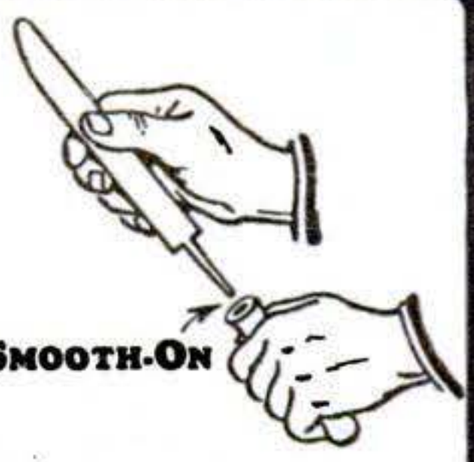

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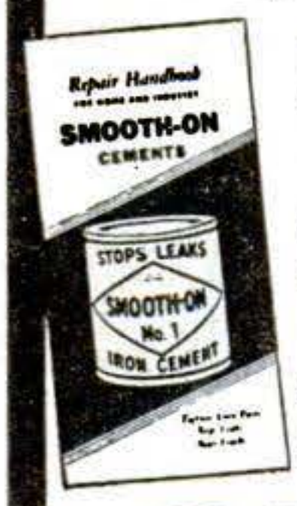

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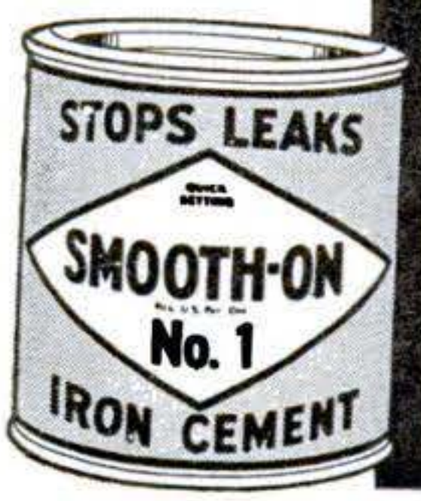

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Extra Money in Spare Time
"Four months after enrolling ... averaged $10 to $15 a week servicing sets in spare time. Now have full-time business."—William Weyde, Brooklyn, New York.

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"Becoming an expert Teletrician as well as Radiotrician. Impossible without your course. Business continues to grow."—Philip G. Brogan, Louisville, Kentucky.

Broadcast Engineer at WLPM
"I am Broadcast Engineer at WLPM. Another technician and I have opened a Radio-Television service shop in our spare time."—J. H. Bangley, Jr., Suffolk, Va.

Video Control Engineer
"My position with WNBT is video control engineer on the RCA color project. I owe a lot of my success to your textbooks." Warren Deem, Malverne, N. Y.

TELEVISION is Making Good Jobs, Prosperity

Radio, even without Television is bigger than ever. 115 million home and auto radios and 3000 Radio Broadcasting Stations give interesting jobs to service technicians, operators, engineers. NOW ADD TELEVISION. 25 million TV homes and the total growing rapidly. 200 Television stations on the air, hundreds more under construction. Color Television soon to be a reality. All this adds up to good pay now, a bright future for men who qualify.

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Nothing takes the place of practical experience. That's why NRI training is based on learning by DOING. My training includes specially developed kits of parts you use to build equipment and get practical experience on circuits common to both Radio and Television. Shown at left is the low power Broadcasting Transmitter you build as part of my Communications Course. Also shown is modern Radio you build as part of my Servicing Course. My free book tells about other equipment you build. Mail coupon. All equipment is yours to keep.

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An important benefit of my Radio-Television training is that you can start to cash in fast. I start sending you special booklets that show you how to fix sets the day you enroll. Multitester you build with parts I send helps you discover and correct troubles, helps you make money fixing neighbors' sets in spare time while training. Many NRI students make $10, $15 a week extra this way. My training is practical, complete. You benefit by my 40 years' experience training men at home. My well-illustrated lessons give you basic principles you need, and my skillfully developed kits of parts "bring to life" things you learn from the lessons.

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Letters—

Ha-Ha, No Boo-Boo!

In your article on the new Buick [Feb., p. 146], you remarked, "The company remains one of two in the U. S. (Nash Ambassador is the other) using a torque-tube drive." If I am not mistaken, my '54 Chevvy has a torque-tube drive—unless I have a hybrid or something. Didn't you make a boo-boo?

S. E. Fried, Omaha, Neb.

Nope. Your Chevvy has a Hotchkiss drive. That sheath around your drive shaft has a slip joint at the bell housing that slides back and forth as much as 1½ to 2 inches. Some rigidity probably results, but the torque from your rear wheels is transmitted through your rear springs.

Nostalgia Won His Heart

I sure liked your 1954 Auto Show in the February issue. The way you wrote up

the 1904 Auto Show and the cars that were popular then was alone worth the price. . . Please keep those old-car, new-car, hot-rod, sports-car articles coming. I eat them up.

Norman J. Geary, St. Louis, Mo.

Paper Race Among Clippers

You told R. J. Dixon in your February Letters column [p. 26] that you were "glad to credit the *Cutty Sark* with the record for top [clipper ship] speed." Please let me make a correction there.

The *Sovereign of the Seas* has been offi-

"Here's the new greaseless way to keep your hair neat all day,"

says Arthur Godfrey

Even Mr. G.'s tousled cowlicks stay put after he uses new Vitalis Hair Tonic with V-7. "It works for me even after a shampoo," he says. "That means it'll work for anybody."

V-7, Vitalis' new *greaseless* grooming ingredient, makes even dry, unruly hair easy to manage. Yet it never gives an over-slick, plastered-down look. And Vitalis prevents dryness—maintains hair's natural moisture balance better than any other leading tonic.

Try new Vitalis yourself! And don't miss the new "Arthur Godfrey Digest." CBS Radio Network, Fridays, 8:30-9:30 PM, EST.

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IN ELECTRICITY

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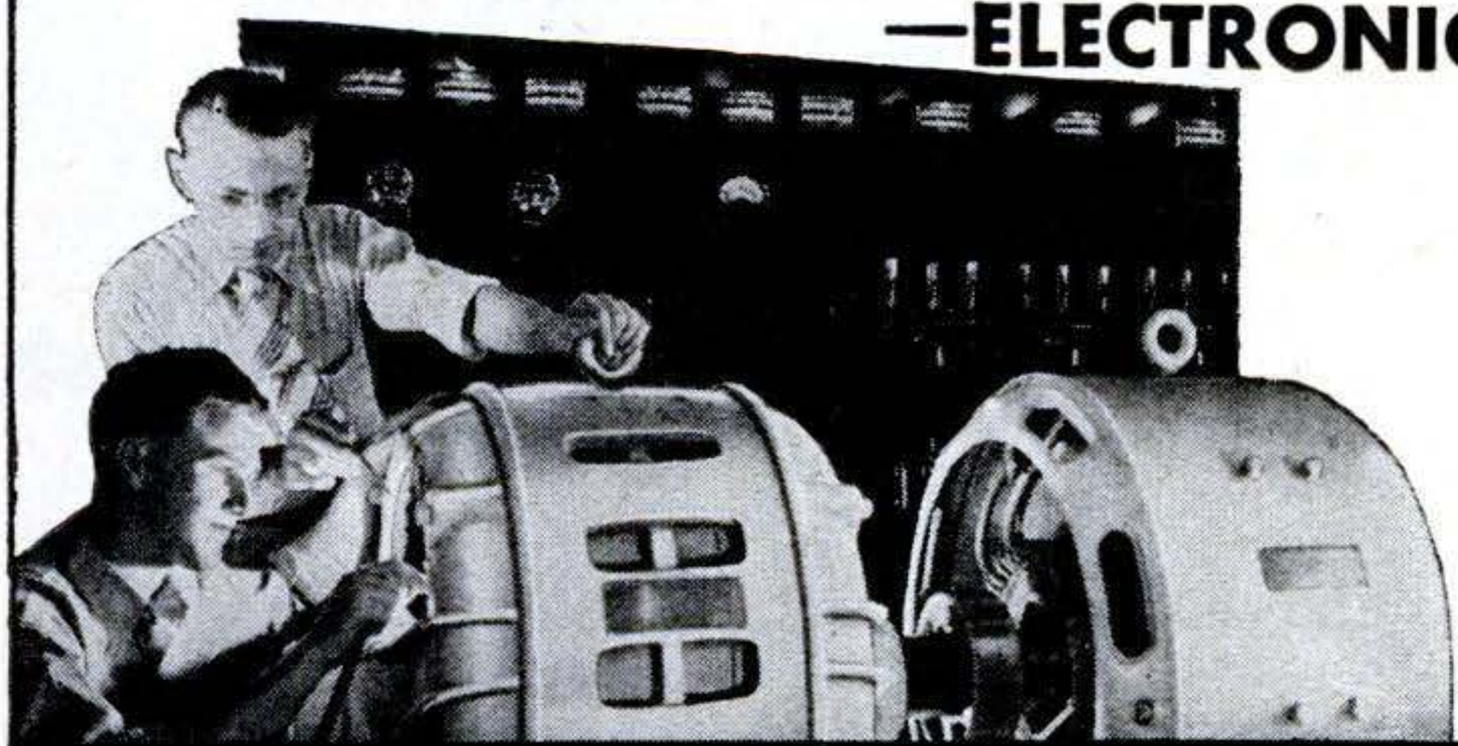

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ELECTRONICS
RECORD CHANGERS
AUTO RADIOS
PUBLIC ADDRESS Systems

(Right—Instructor helping students check the wiring and trace circuits of television receivers.)

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Reading time: 3 minutes to learn how to

- **cut engine wear up to 38%**
- **prevent loss of power, compression**
- **save 15%-25% on oil . . . without ever changing your oil filter**

This Gadget is Worth $320,000,000

...and I Discovered it by Accident!

by Albert Wells

IT ALL STARTED the day I got the bill: $214.36 for an engine overhaul—and I had only 28,000 miles on the car!

I told my troubles to a neighbor—a lubrication engineer—told him how I'd always changed oil every 1500 miles, changed filters every 5,000 miles. His answer floored me.

"You've been wasting your money," he said. "We've spent millions developing oil additives that keep carbon, gum and abrasives from damaging your engine. Your oil costs about 15¢ more a quart because of those additives. Yet oil filters on the market today are made of rag or paper—they soak up additives like a blotter. The more often you change oil filters the more money you waste!"

"But don't I need a filter to take the impurities out of the oil?" I asked.

He took a deep breath. "This will really shock you. Engine damage is done by abrasives 10 to 40 microns in size (a micron is .000039"). Your oil filter can't take them out because rags or paper can't be packed tight enough without stopping oil flow when the fibers soak up oil and expand."

"Isn't there any kind of filter that does the job it's supposed to do?"

"No, except for the porous bronze filters they're making for supersonic aircraft. And you can't buy a filter like that for your car."

I asked myself: "Why not?" Next day, I tracked down the outfit that was making the filters for aircraft, and got the answer. These porous bronze filters were made by fusing together millions of tiny bronze balls. Non-absorbent, they didn't remove additives, yet they removed abrasives in the 10-to-40 micron danger zone. Could they be made for automobiles? Again, the answer floored me.

LIFETIME FILTER TESTED IN CARS, TRUCKS, BOATS

Test models had already been used in cars and trucks for millions of miles, proving the porous bronze filter: 1. Never needs replacing. 2. Saves the quart of oil thrown away with ordinary filter packs. 3. Increases engine life.

Trouble was, almost the entire production was being absorbed by military and industrial users.

That day I went to work on the biggest job of my life: setting up production of the Lifetime porous bronze permanent filters for cars and trucks (an estimated $320,000,000 replacement industry).

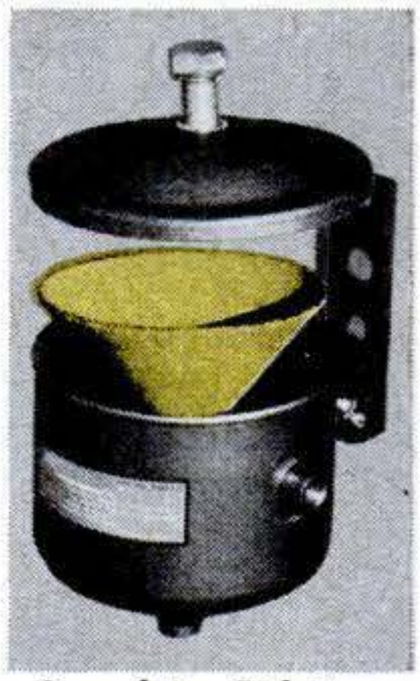
HOW TO GET A LIFETIME FILTER FOR YOUR CAR

Try the Lifetime filter on your car for 2 weeks: if it isn't all I say, you get your money back; if you keep it, you're through buying filter packs—the Lifetime filter is guaranteed for 10 years, actually will last many times that long.

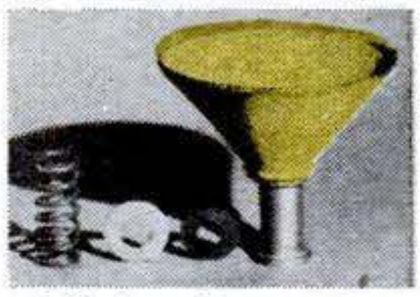
For complete unit, including case and fittings (install on any car in 10 minutes), send make, year and model of your car and $12.95 (we pay shipping).

For conversion kit, which replaces your present filter pack with Lifetime bronze, send make and number of filter and $6.95 (we pay shipping).

Or send only $2 deposit, pay C.O.D. charges on arrival. But do it today—don't waste another cent on filter pack replacements!



Complete Lifetime Filter; fits any car.



Lifetime Conversion Kit; replaces ordinary packs with permanent bronze element.

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A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

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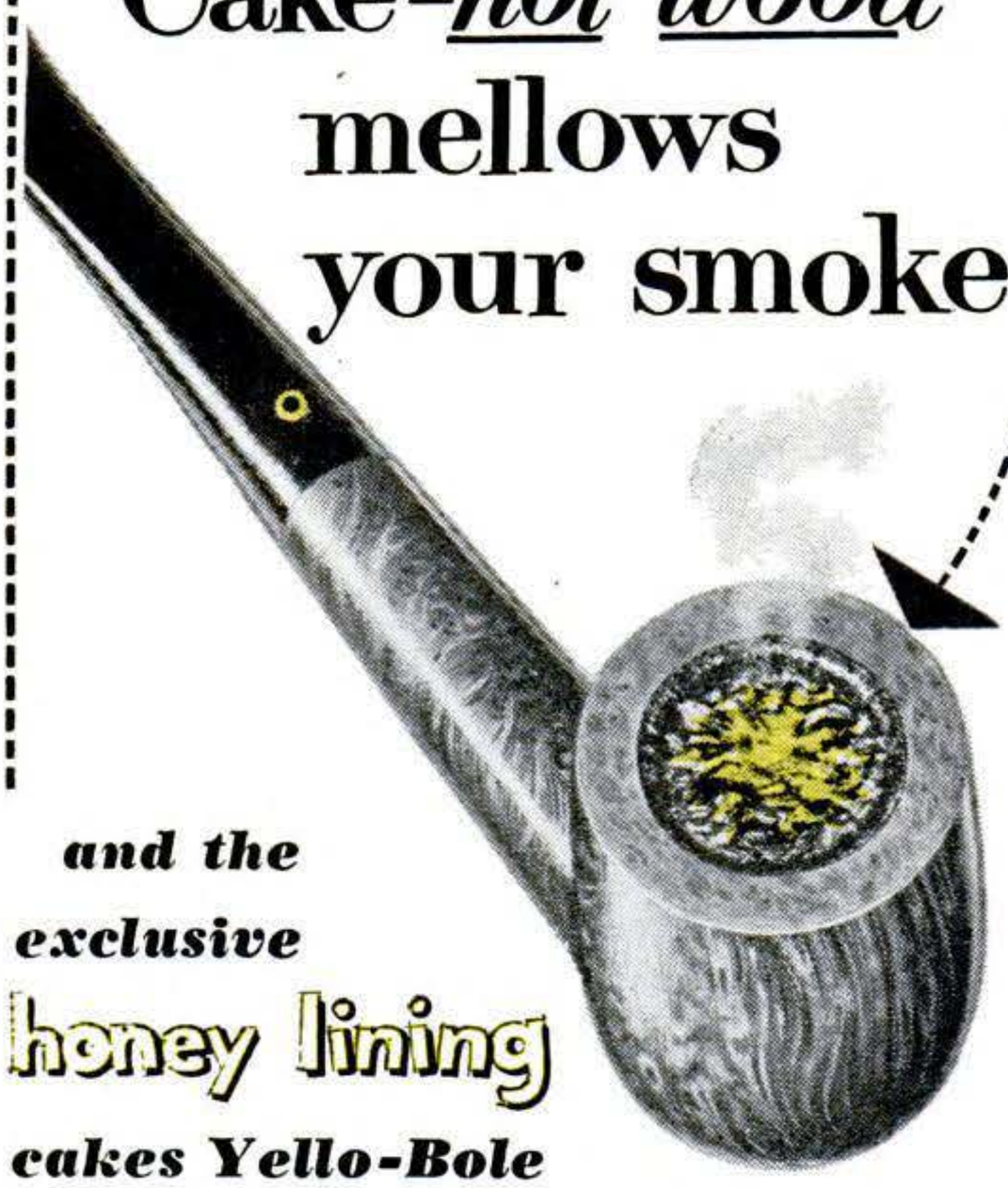
"Cake"-*not wood* mellows your smoke



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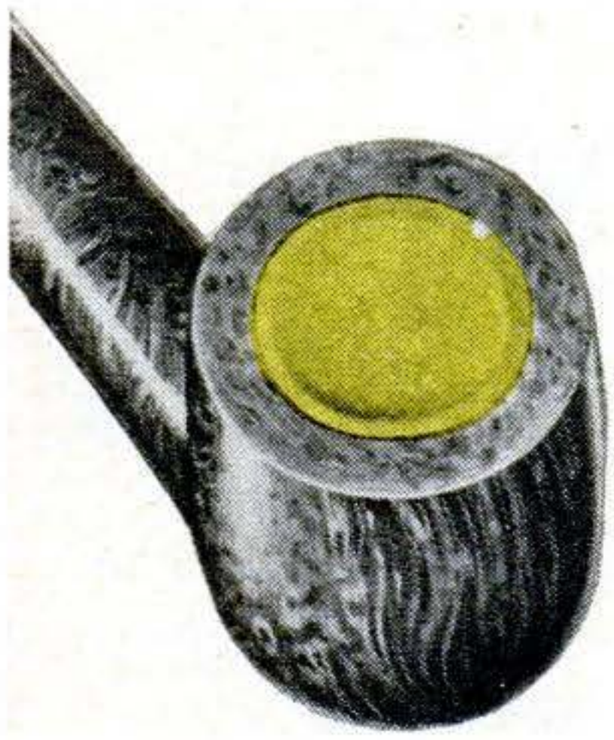

From the first puff, Yello-Bole's real honey builds up a healthy, protective cake. It mellows the smoke, absorbs tars and resins. The filter *refines* the rest. Yello-Bole smokes so clear, clean, cool and sweet you don't have to inhale to enjoy it. Treat yourself to a healthier-smoking, honey-lined Yello-Bole—in handsome new shapes and finishes!

PROOF?

Yello-Bole is the world's largest selling pipe

YELLO-BOLE

$1.00 TO $2.50

cially credited with having traveled at a rate of 19 knots—during the record run of 3,562 miles in 11 days that you mentioned —for three consecutive hours.

Just to set matters straight on the question of actual top speed, it should be noted that the *James Baines*, built by the same Donald MacKay who built the *Sovereign*, made 21 knots.

In all fairness to the *Cutty Sark*, it should also be noted that the larger a ship, the higher its top speed will be, other factors being equal. Since both the *James Baines* and the *Sovereign* were larger than the *Cutty Sark*, this probably accounts to a certain extent for the differences in their respective top speeds.

DAVID RICHARDSON, Madison, Ill.

We would have liked to line the three ships up on a day of fair wind and settle this dispute for all time.

A Cure for Noisy Drivers

I'd like to see somebody make an automobile horn that would blow just as loudly

inside the car as outside. It would surely be educational!

FRANK VICTOR, Ph.D., New York, N. Y.

A Safety for a Sander

Following your plans for building an electric road sander [Nov., p. 230], I built a set for my car. Moreover, I added a safety feature that has worked very well and that others might like to adopt for their sanders.

Instead of the switch described in the article, I used a double-pole, double-throw switch with a center off. I hooked one set of terminals to the hot side of the ignition switch, for working the sander manually. I hooked the other set of terminals to a wire from the stop-light switch through the toggle switch to the sander. Thus, flipping the toggle switch one way works the sander manually; flipping it the other way causes the sander to work automatically when I apply the brakes. In center position, of course, it doesn't work at all.

I even found that by holding the brakes

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If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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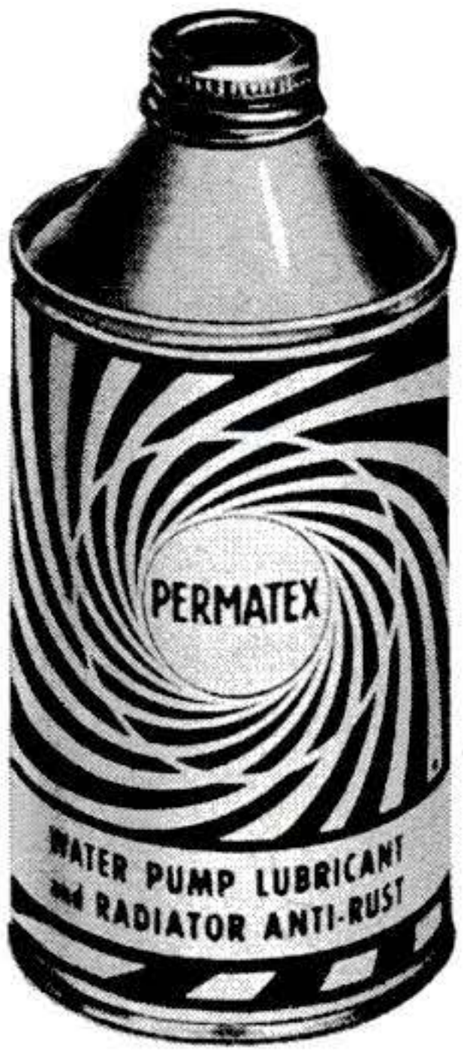

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for a few seconds after my car had stopped at a stop light, I caused the sander to drop enough sand to start me up easily at icy intersections.

EUGENE J. GRENZ, Bismarck, N.D.

He Shoots Oil from the Hip

Every time my lawn mower squeaked, I used to run into the house, where I keep my oilcan. Now I carry a supply of oil in my hip pocket—in my son's discarded plastic

water pistol. I find it handles a lot of other outside oiling jobs, too.

ALBERT W. STEIN, St. Petersburg, Fla.

No Overdrive in GM Cars

Why hasn't it been possible to buy Chevrolets equipped with Overdrive during the past few years, when it has been available for Fords, Plymouths, etc.?

J. W. BOISSINOT, Middlebro, Manitoba

Because Overdrive is not just a name applied loosely to an optional fourth gear. It is a specific, patented product produced by the Warner Gear Division of the Borg-Warner Corp.

As a matter of company practice, none of the GM divisions buys transmission units outside the parent corporation.

Slight 1,200 % Error

Mr. Johansen certainly rates bouquets for his interesting and skillfully written story, "TV Antennas Made Him Rich" [Feb., p. 117]. In an article so full of facts and figures, it was surprising to find only one slight error. The Channel Master Corp. in 1953 used 5,000,000 pounds of aluminum, not 400,000 pounds, as was stated. The 400,000-pounds figure represented the monthly consumption.

HAROLD HARRIS
Channel Master Corp., Ellenville, N. Y.

No Sooner Said Than Done

One of your readers recently indicated that he would "like to see them make" an electrically heated windshield scraper [Jan.,

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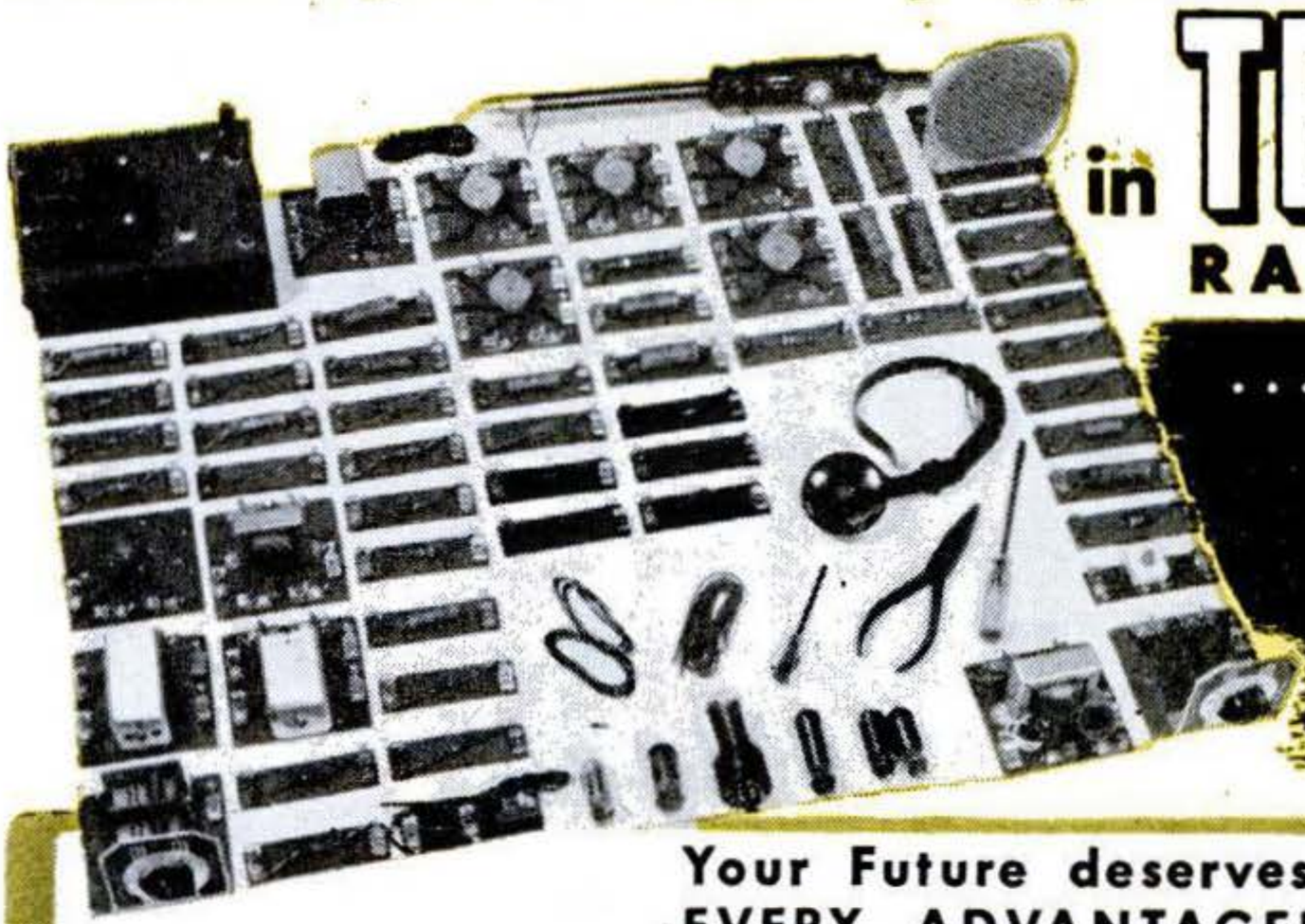

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p. 159]. Two years ago I applied for a patent on a scraper very similar to the one you depicted. We have just started production on them this year and have sold a few thousand already.

JAMES D. CLEMENTS
Mosey Tool Co., Richmond, Ind.

Nash Rambler's Carrier Top

I would like to point out that the carrier top that you referred to as "optional" for the new Nash Rambler four-door station wagon [Feb., p. 135] is actually standard equipment on that model.

JOHN R. PICHURSKI
Nash Motors, Detroit, Mich.

Keeps Car Facts on Cards

I thought that you, as well as other readers, might like to know that along with your "Information File" cards, I save the "Facts on Cars." I noticed that they fit on a 3-by-5 card nicely with a little snipping, and I started my file back in 1951. It comes in handy when someone asks me

for information on a certain car of a certain year.

ROBERT WEINFELD, Bronx, N. Y.

A Short History of Hardtops

At the end of your article on the new Mercury [Jan., p. 138], you said hardtops were introduced in 1950. I think I have seen 1949 Buick Roadmaster hardtops, and I have heard of one made by Chrysler around 1946.

ROBERT M. FLEMING JR., *Pittsburgh, Pa.*

Right you are—on both counts. Buick did bring out a Roadmaster hardtop in July, 1949. And 'way back in 1946 Chrysler offered a "Custom Club Coupe" which was a true hardtop in that there was no center post and the rear quarter-window rolled down into the body just as it does in the convertible. Chrysler says that only a few were made because of the postwar rush to get as many standard models as possible to a car-hungry public.

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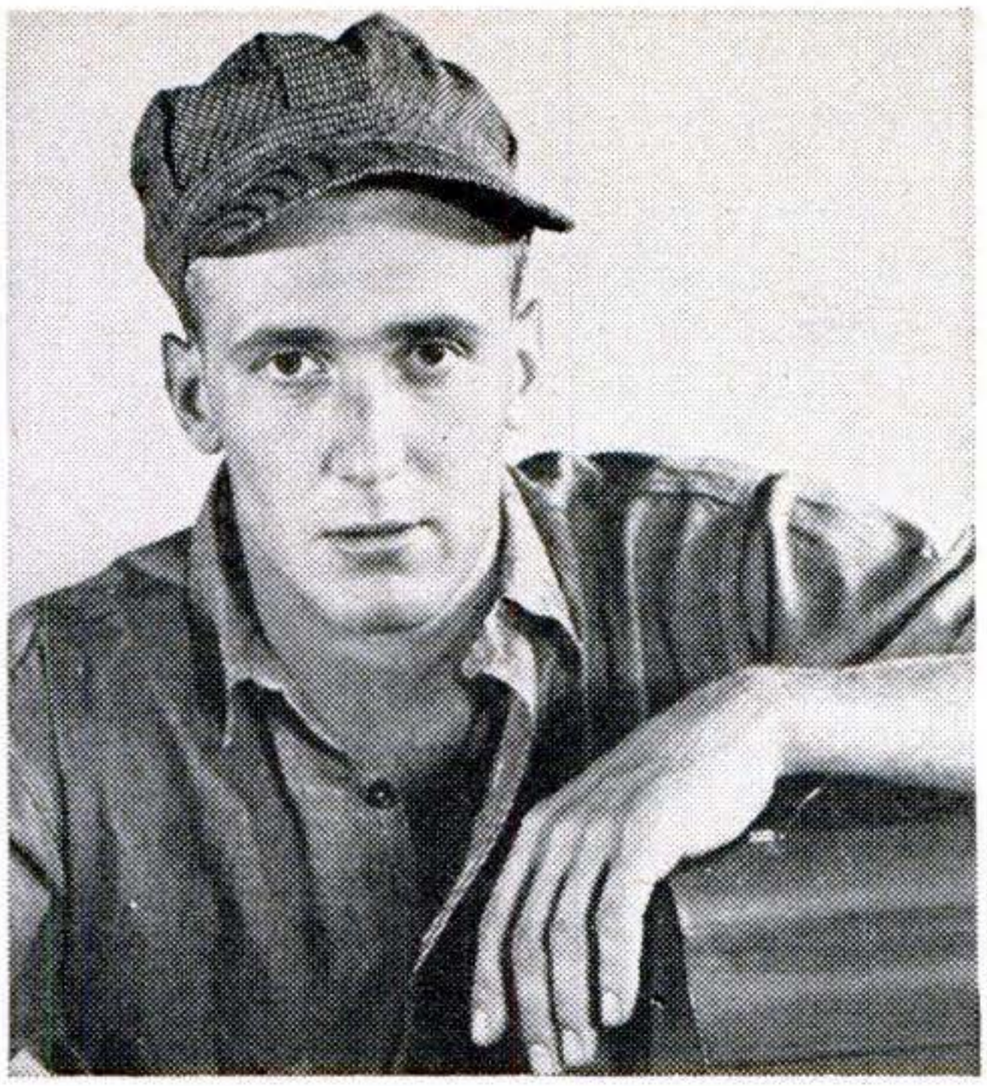

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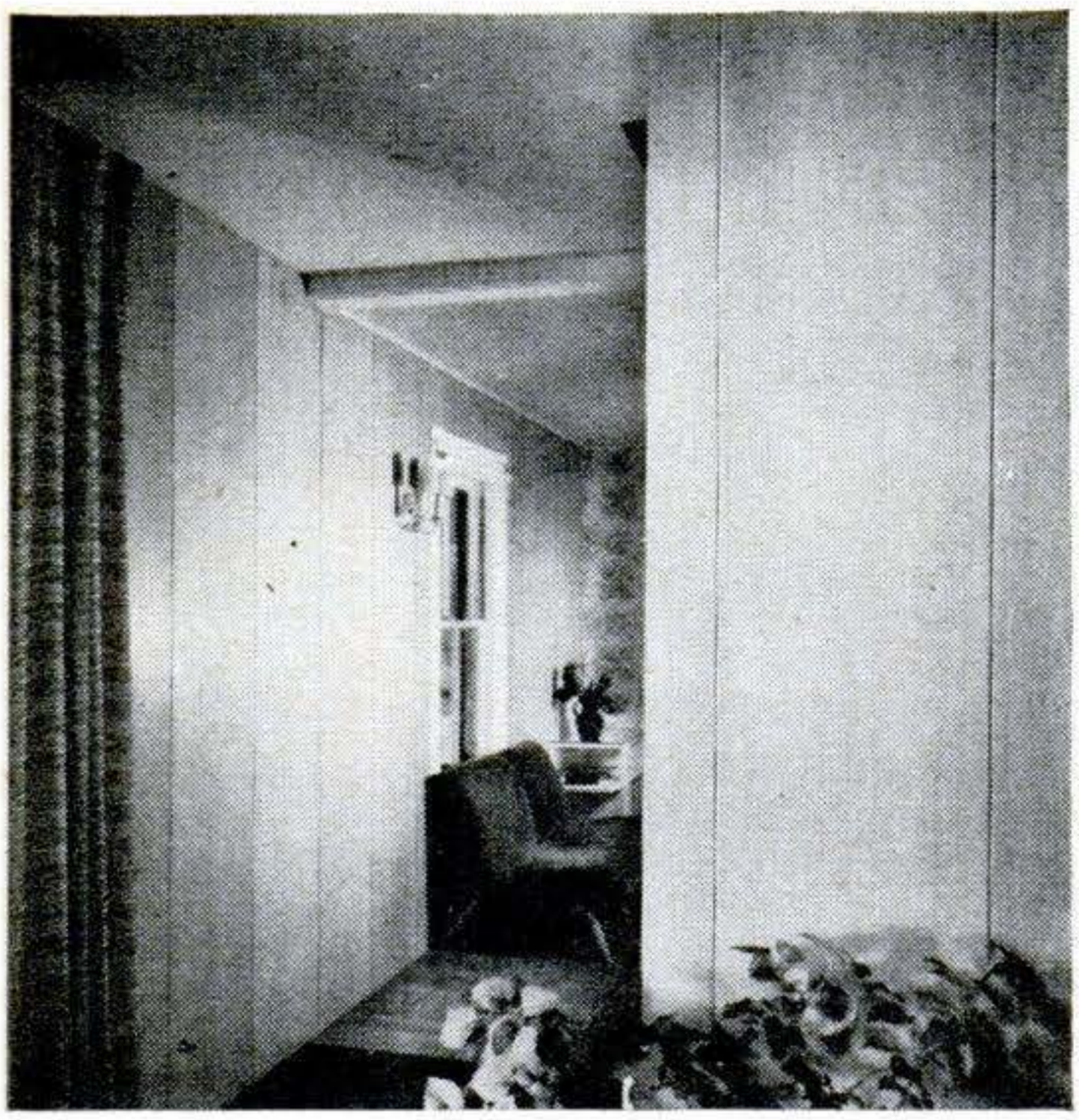

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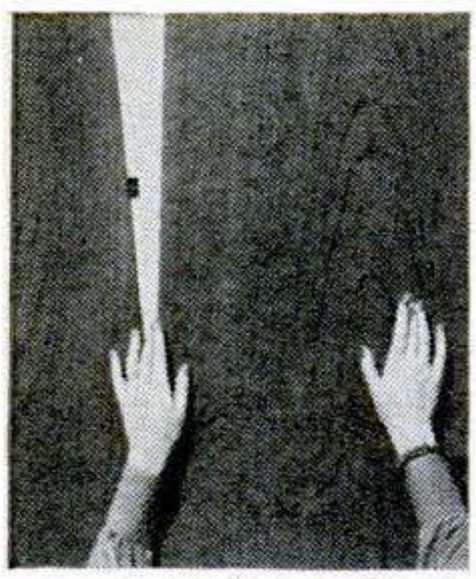

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Headlights of Future to Be 10 Times Brighter, Non-Blinding

HEAD LAMPS producing 10 times as much light as today's, yet without blinding approaching drivers, are predicted for cars of the future. Other developments foreseen by Val J. Roper, GE illuminating engineer, are:

- Fluorescent lamps to light the luggage compartment and the engine;
- Infrared lamps to keep windshields free of ice, snow and condensation;
- Instrument panels lighted by electroluminescence;
- Fluorescent lamps, recessed in the bottoms of all doors, that light automatically when the doors are opened;
- "Black light" to illuminate fluorescent knobs on switches and other controls;
- A swivel-type dome spotlight to supply a concentrated beam of light which will not annoy the driver;
- Indicator lamps that light up to show trouble in the form of a burned-out head lamp, low oil pressure, high water temperature, low oil level in the crankcase, low water level in the battery;
- Turn signal and stop lamps brighter by day in order to be more readily visible in bright sunlight;
- Tubular fluorescent sources to mark all four corners of the car, red in the rear and amber in front;
- A small light on the left front door that will shine a white light downward to illuminate the keyhole, a white light to the front and a red light to the rear to serve as parking lights.

The problem of getting more light with less glare from head lamps will be solved by polarization. The lamps themselves Roper sees as gaseous-discharge types, similar to mercury lamps today, rather than incandescent bulbs.

They will operate at a relatively high pressure and high temperature, and will be several times as efficient as current tungsten-filament types. They will be somewhat larger than present head lamps, and will be of higher wattage. Their lenses will be polarized.

So that motorists will not be blinded by approaching "searchlights," windshields also will be polarized, but at night only. The flick of a switch will remove the polarization for driving on well-lighted highways and streets, and for driving in the daytime.

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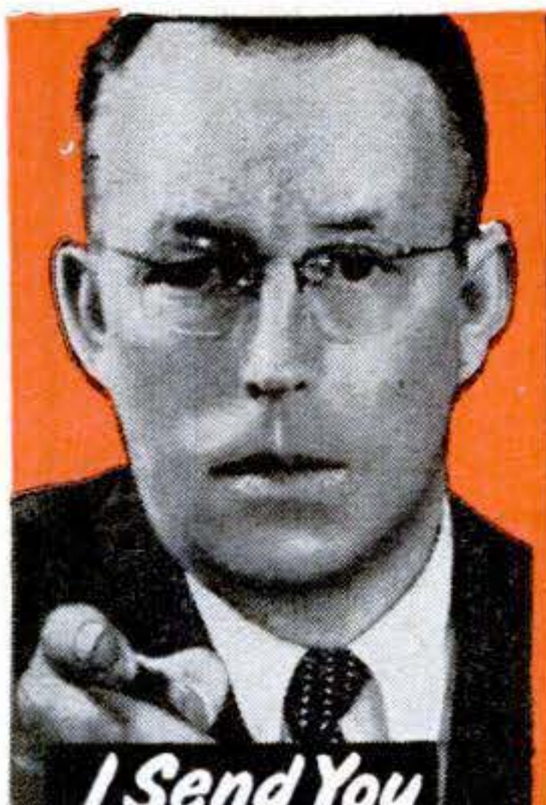

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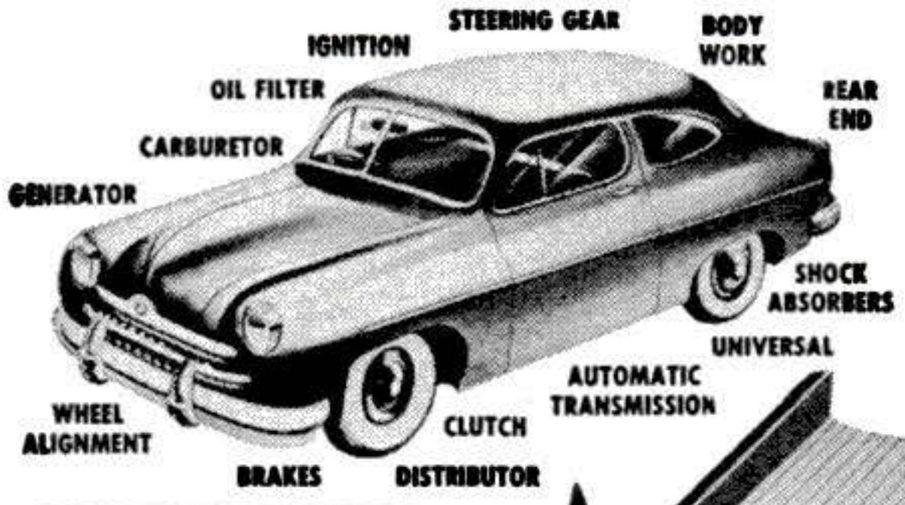

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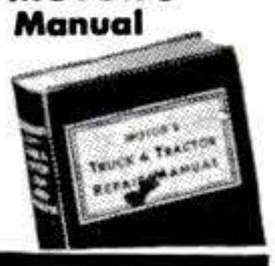

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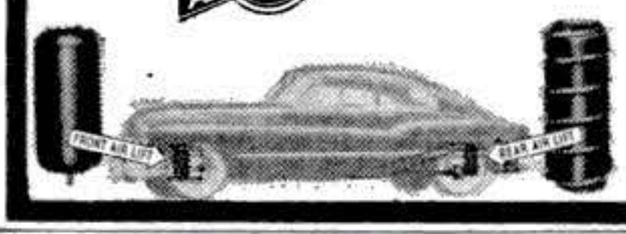

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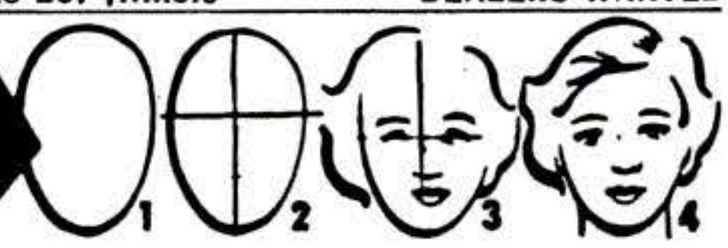

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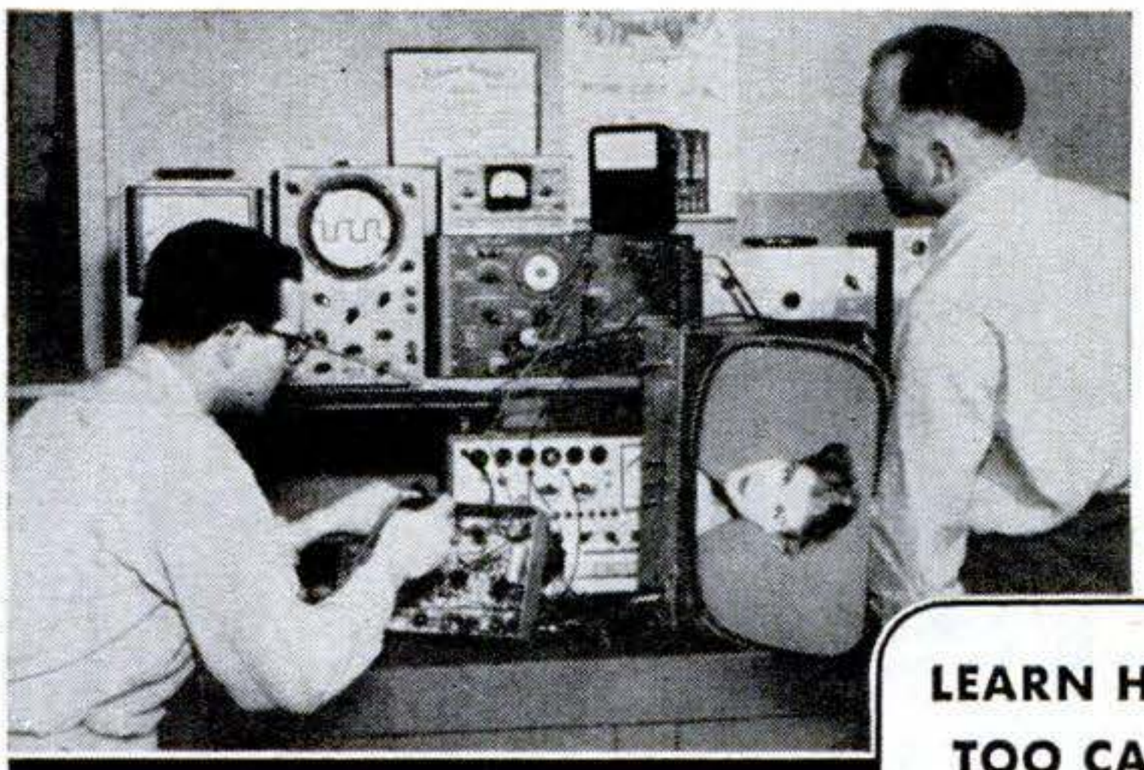

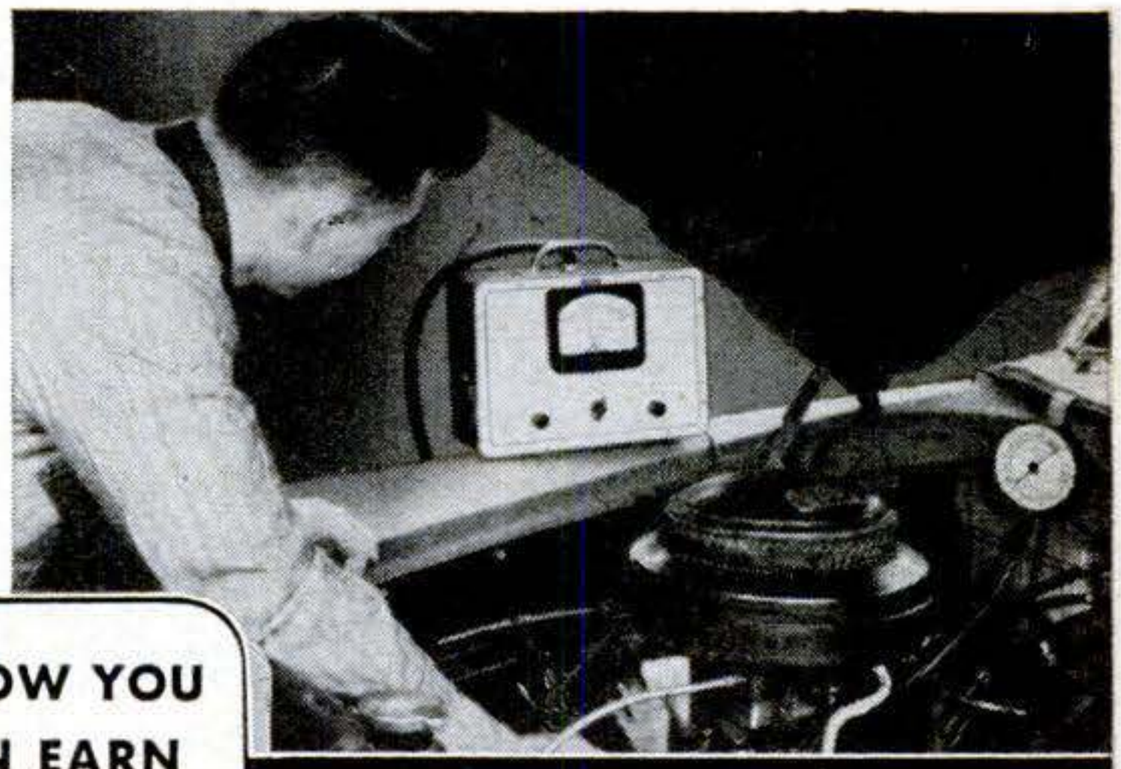

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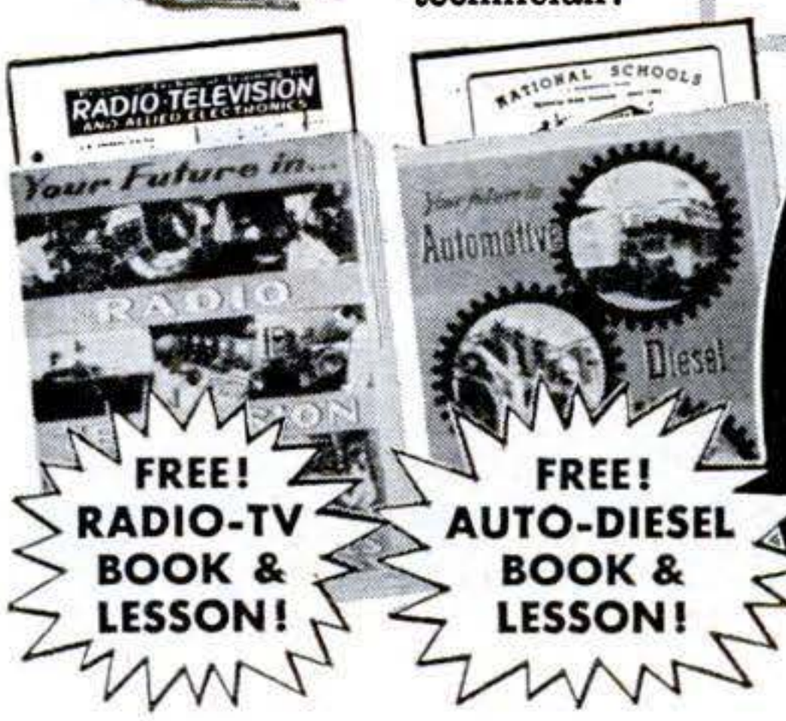

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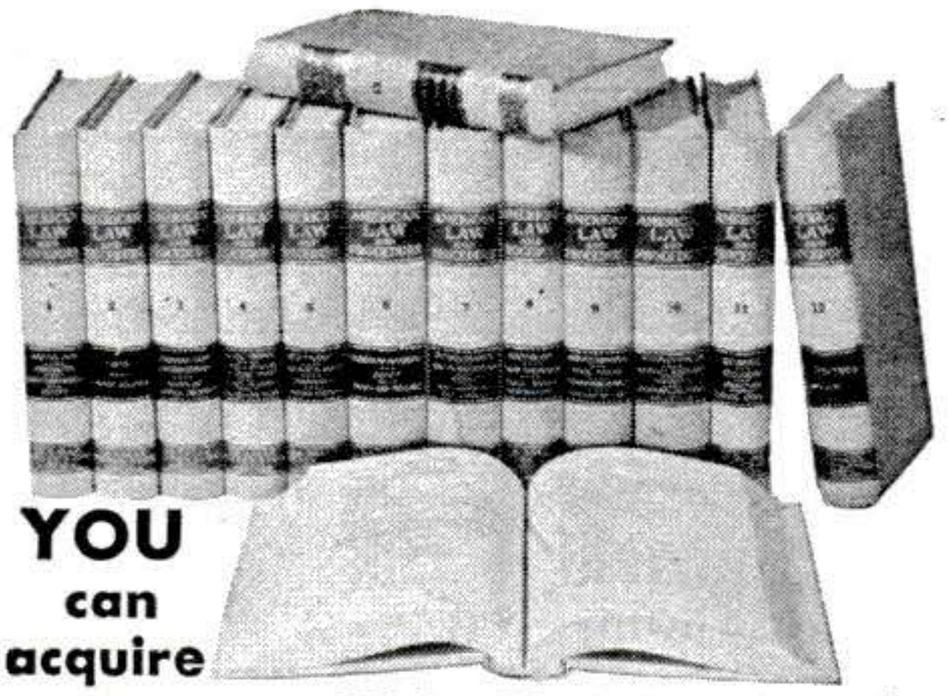

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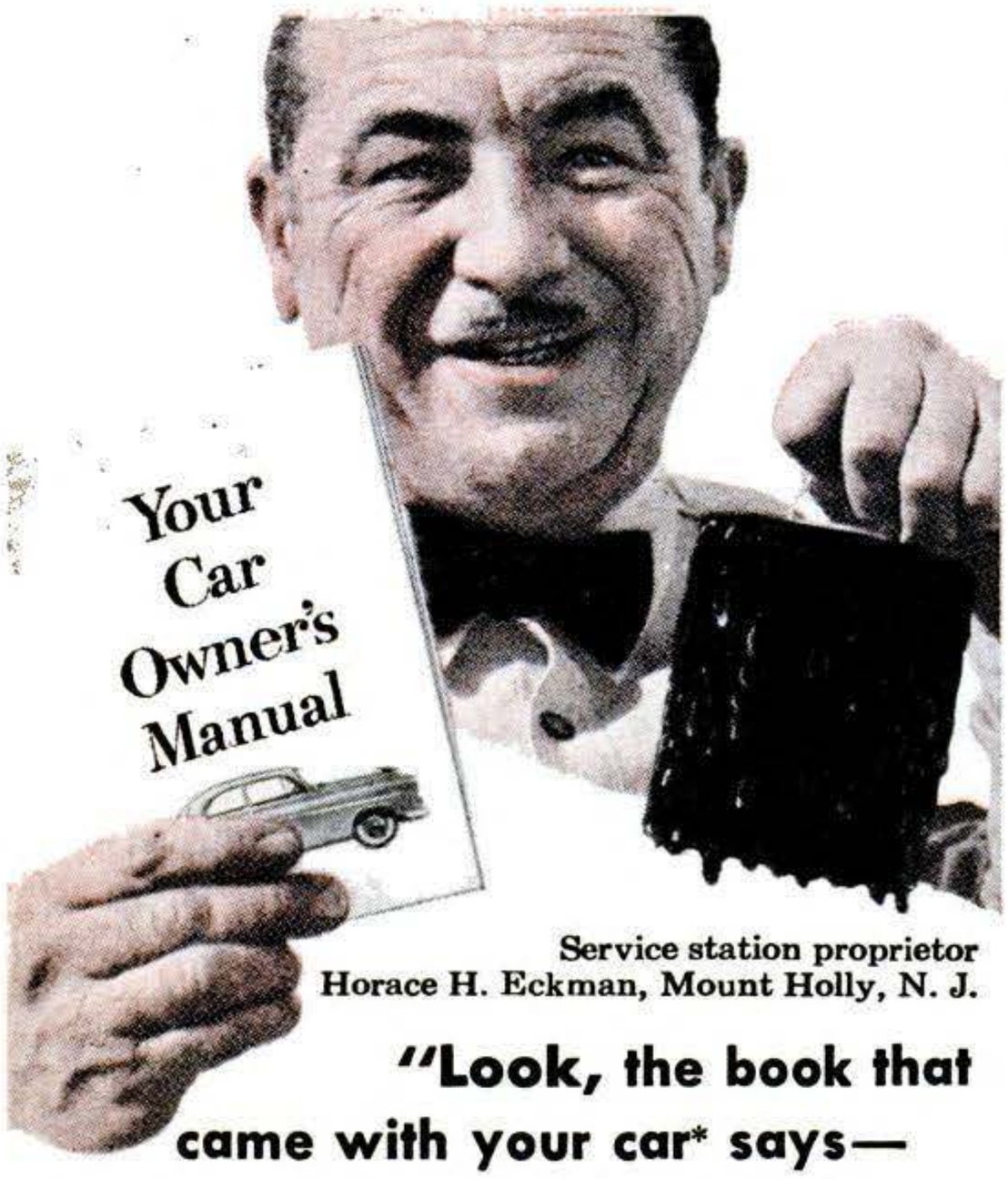

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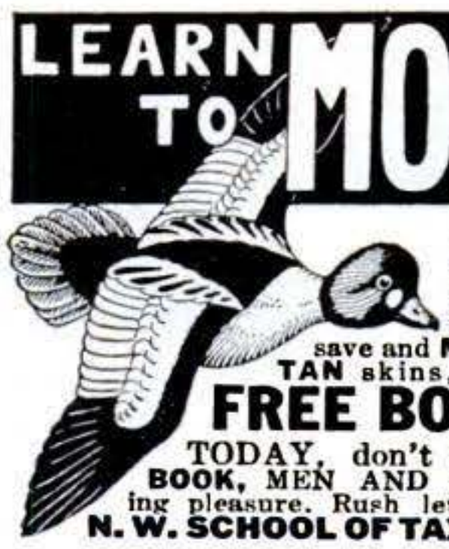

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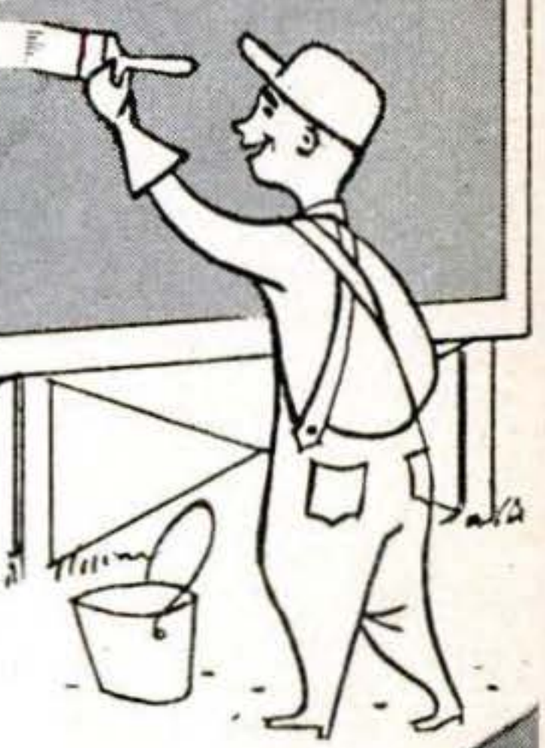

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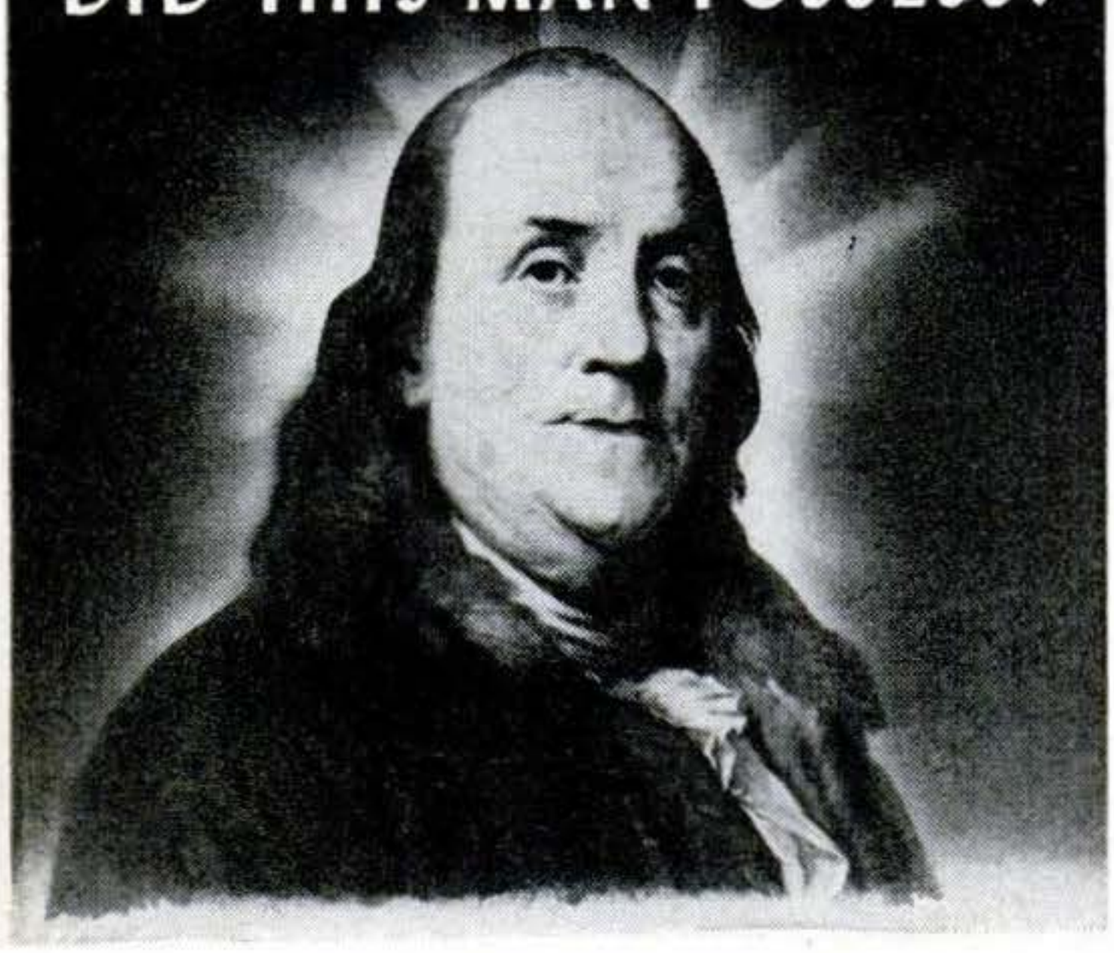

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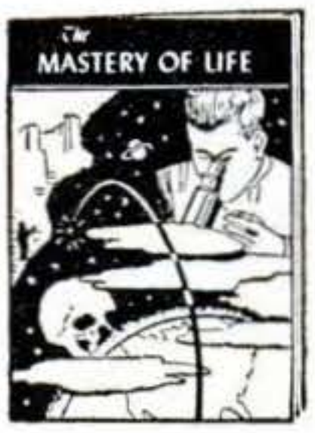

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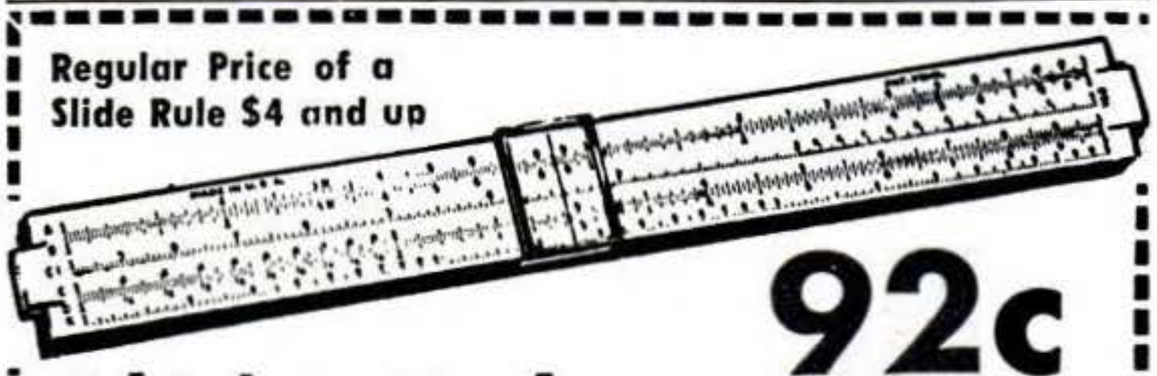

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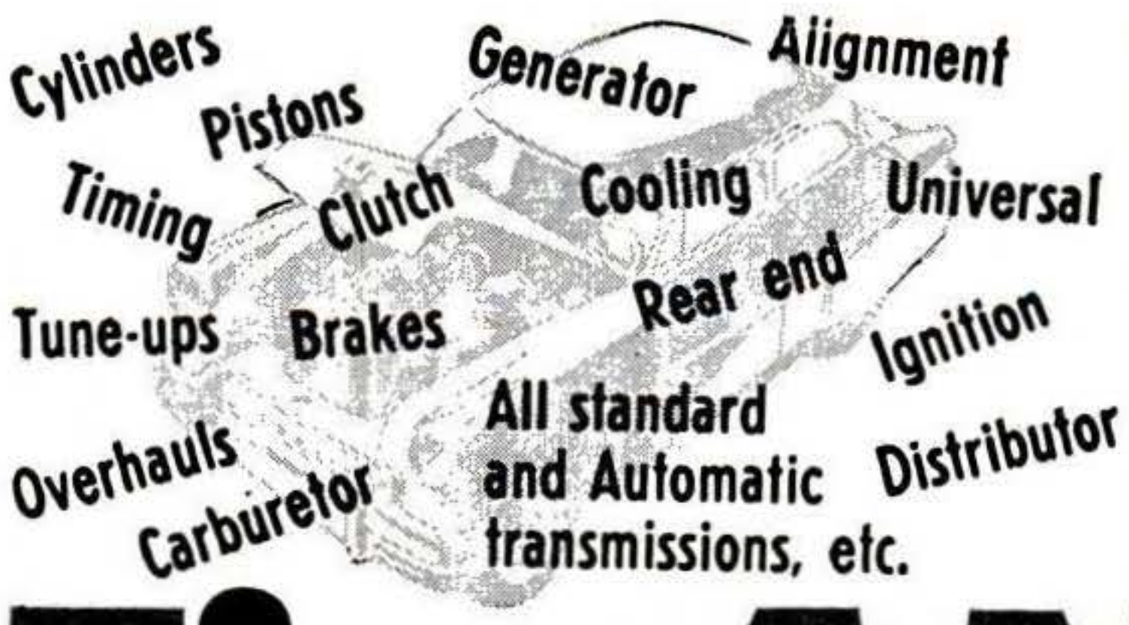

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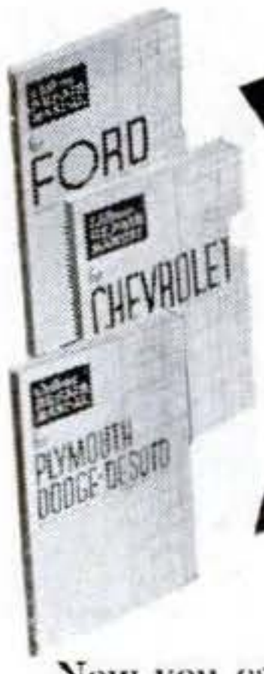

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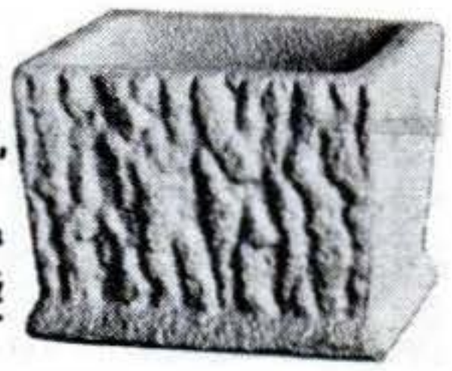

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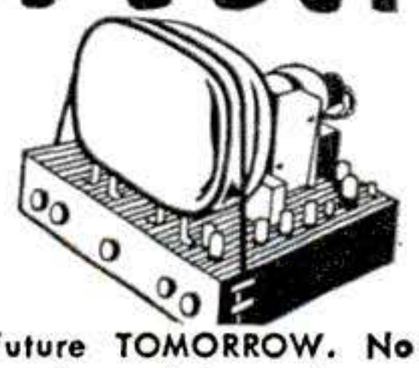

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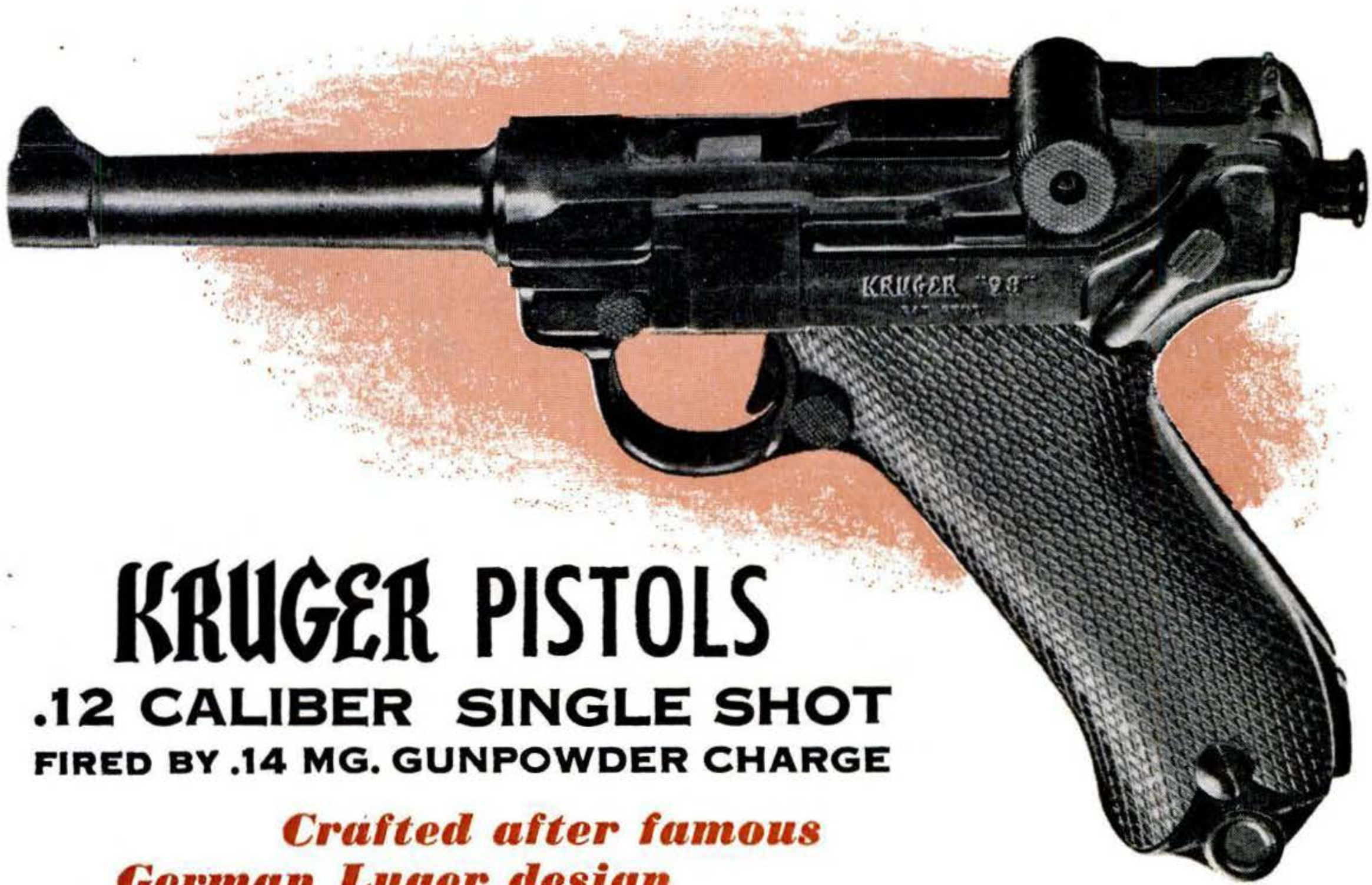

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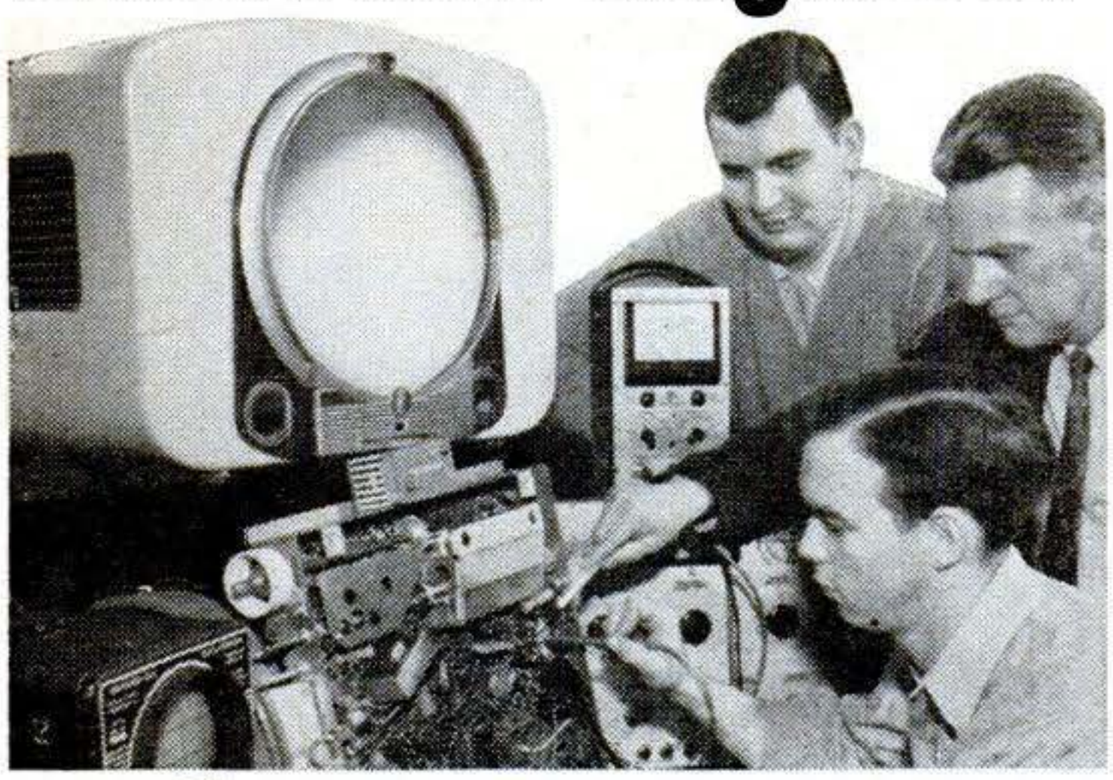

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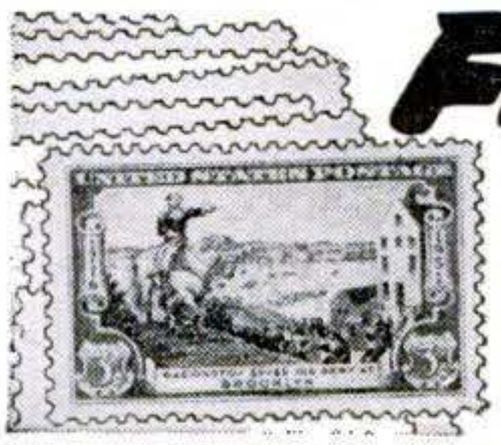

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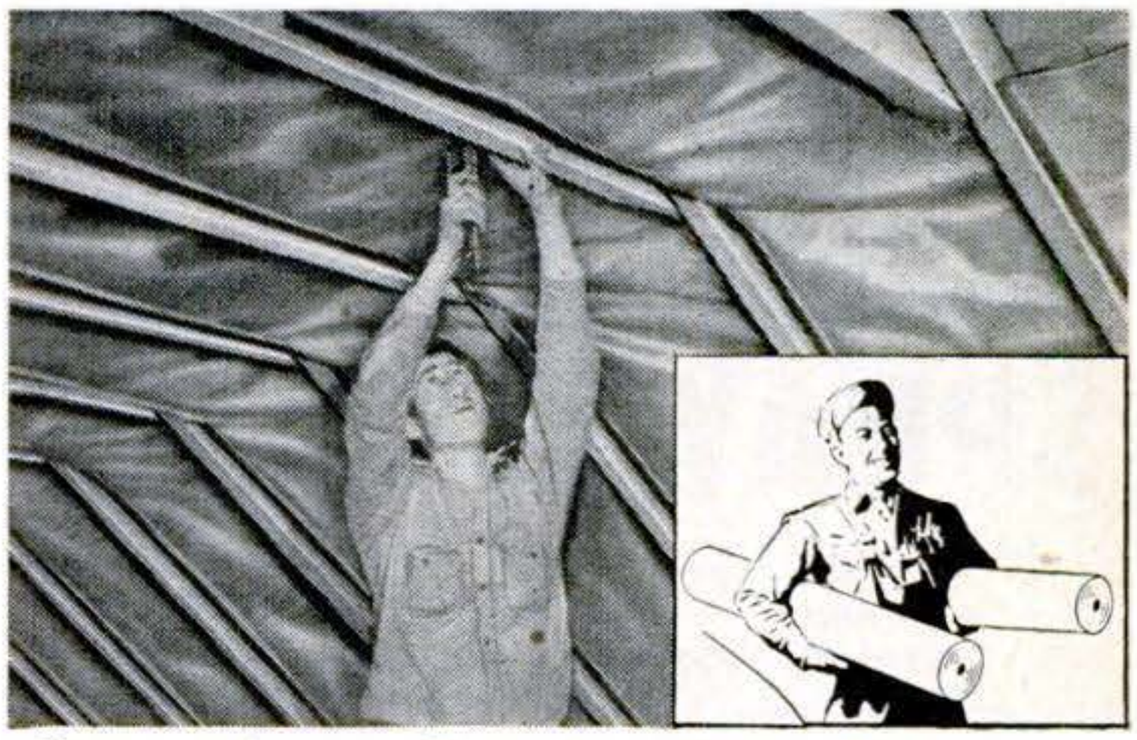

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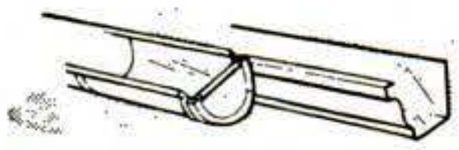

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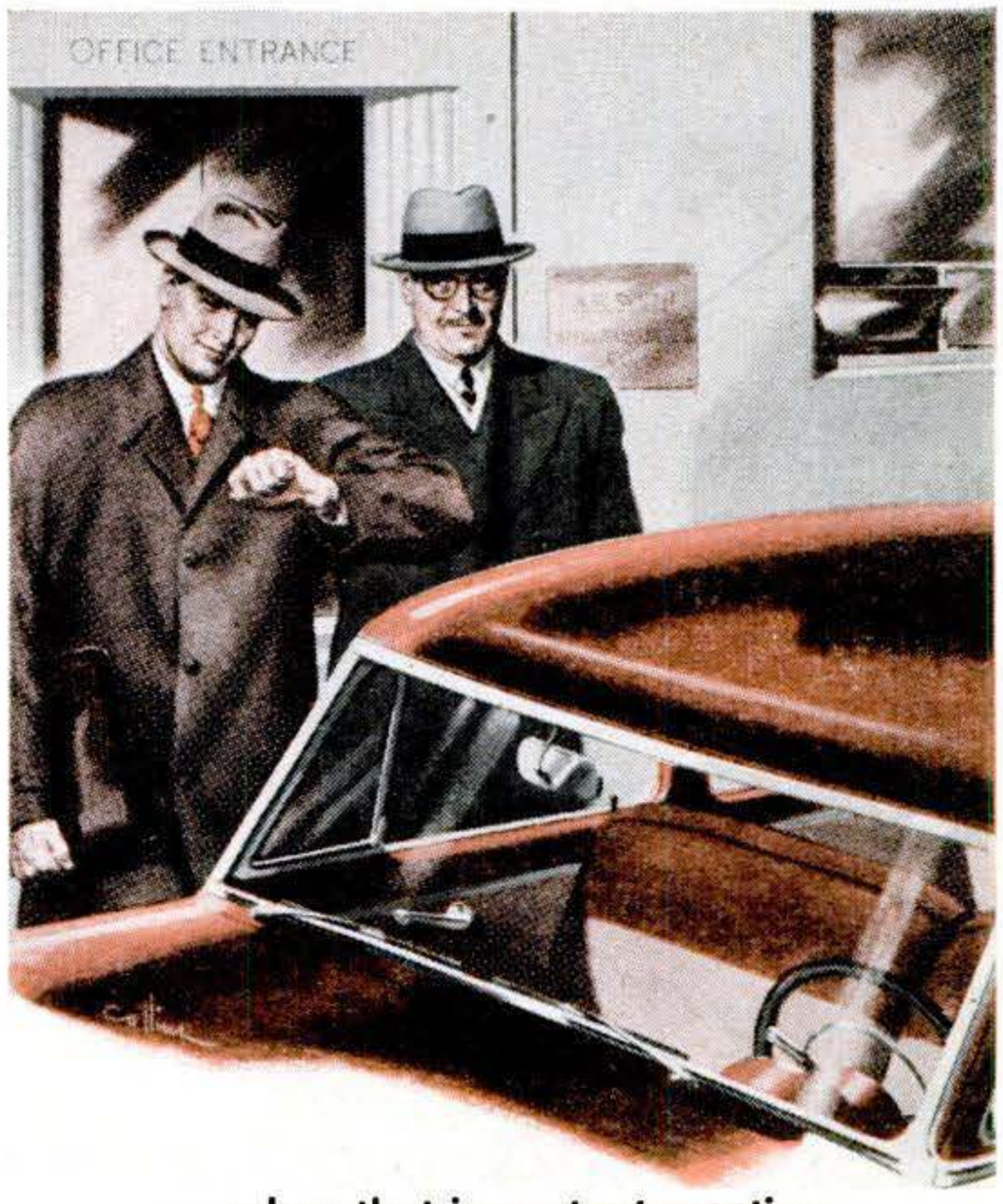

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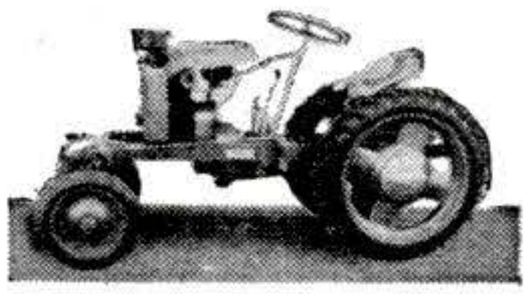

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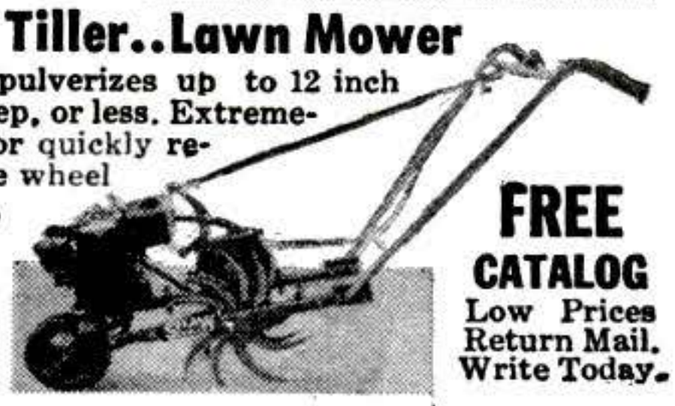

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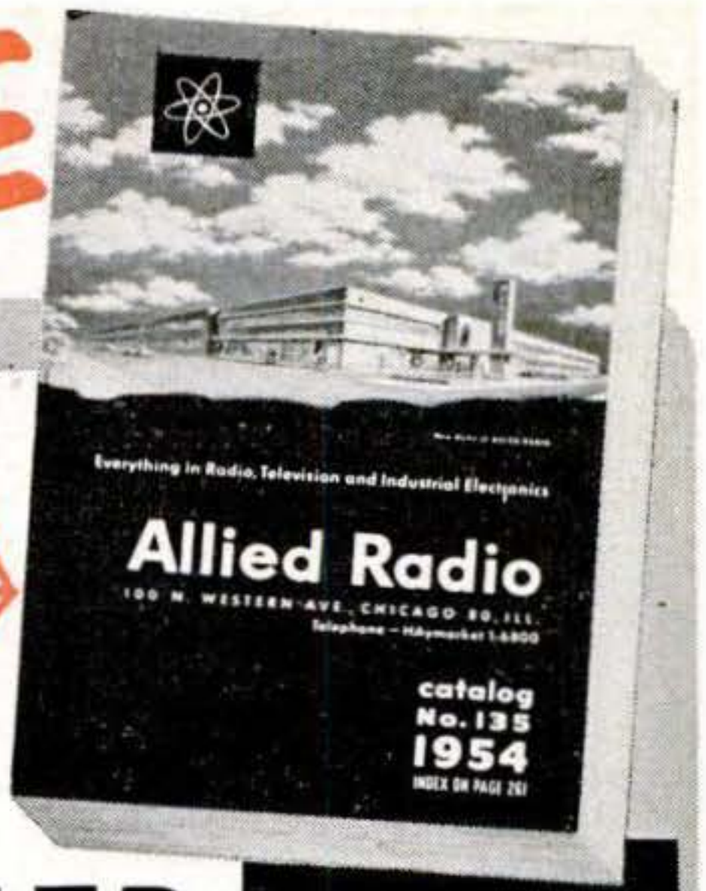

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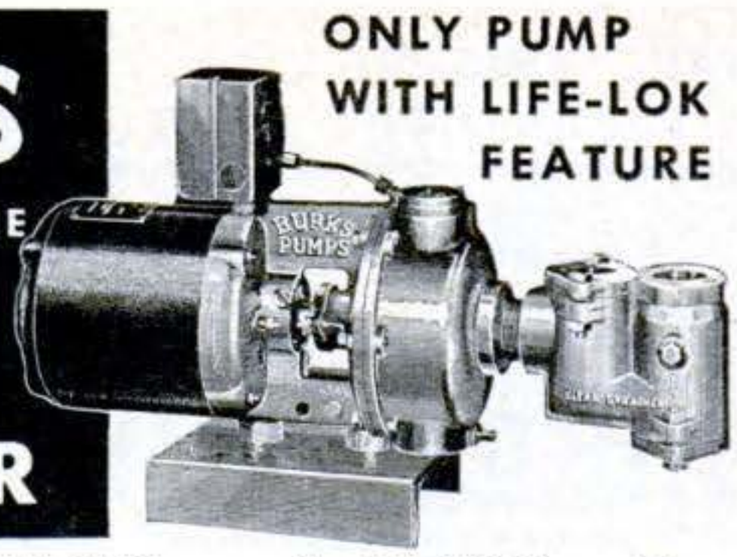

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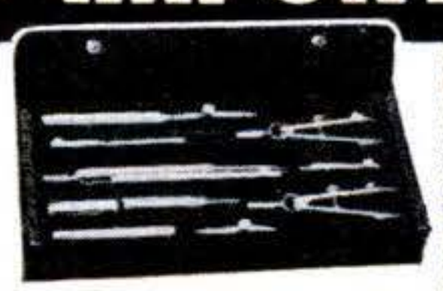

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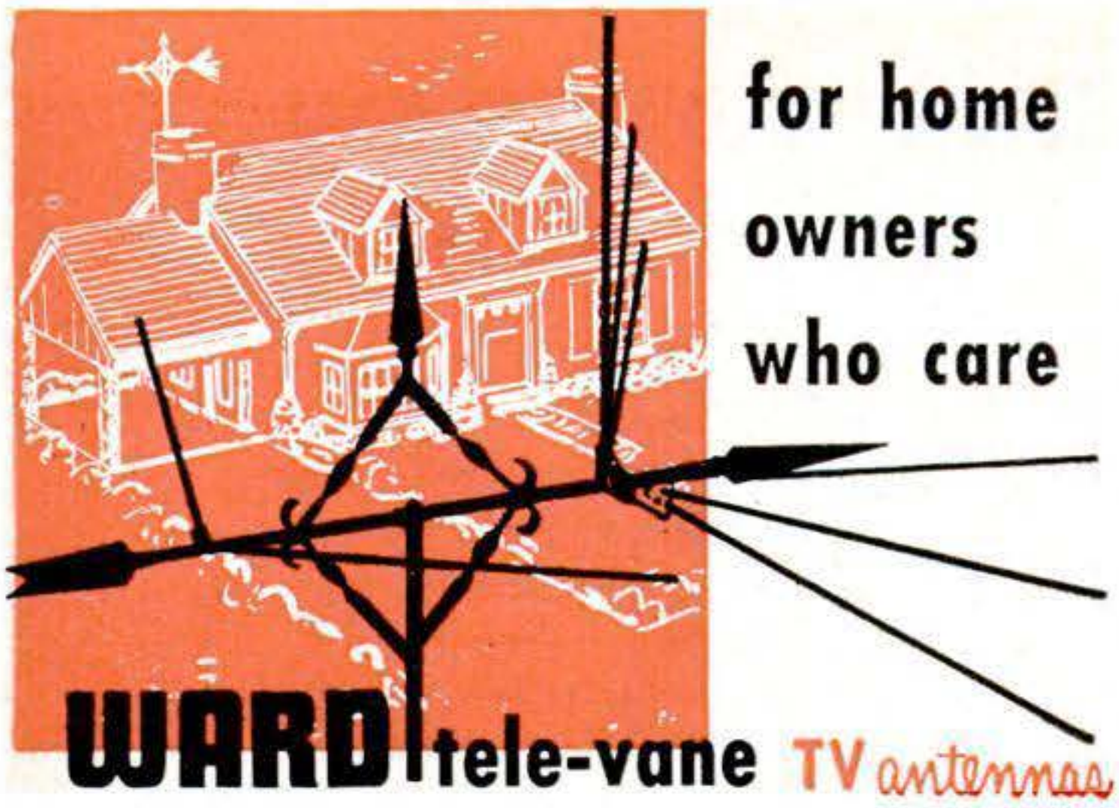

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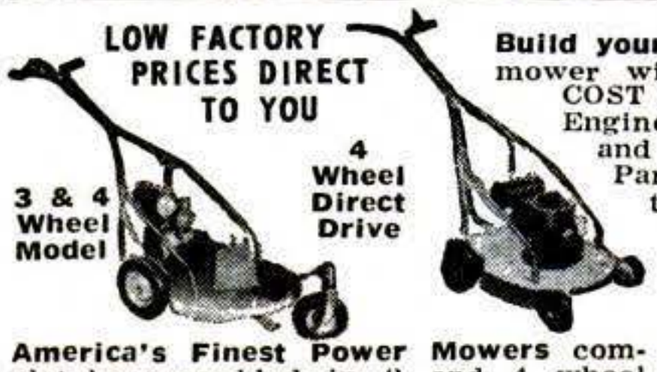

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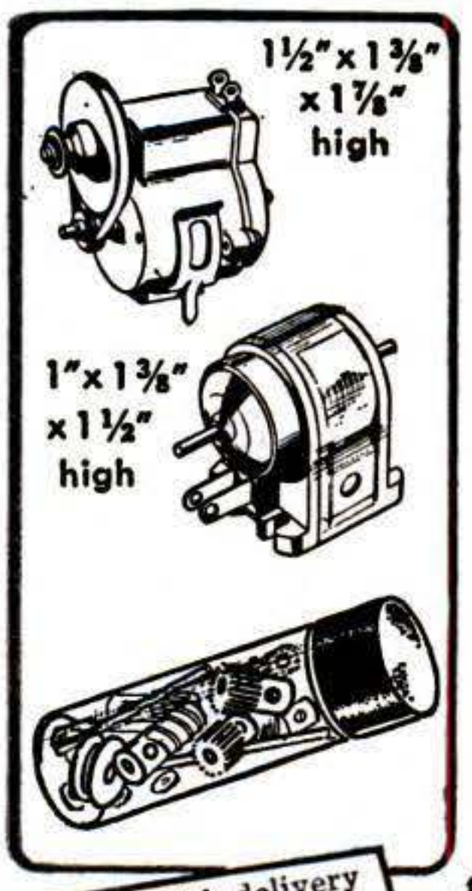

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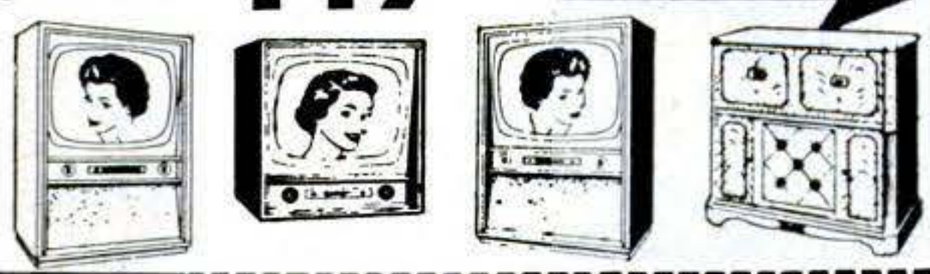

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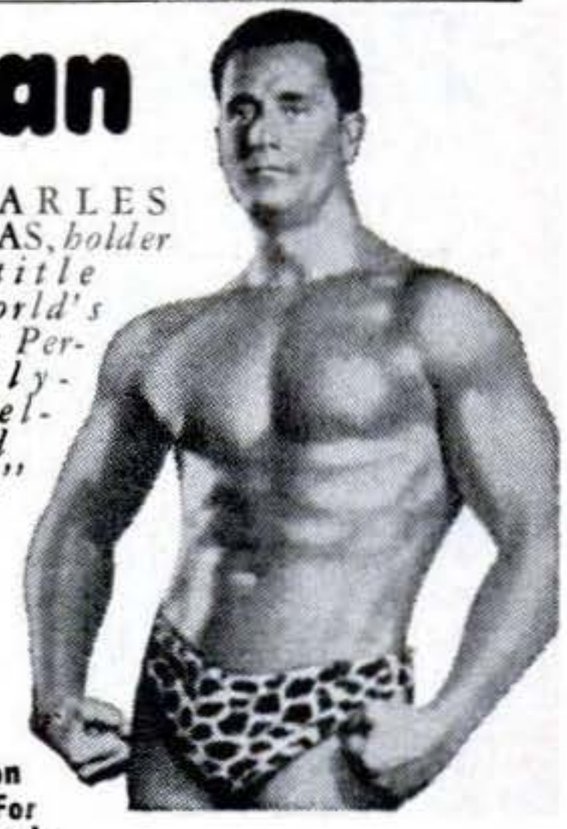

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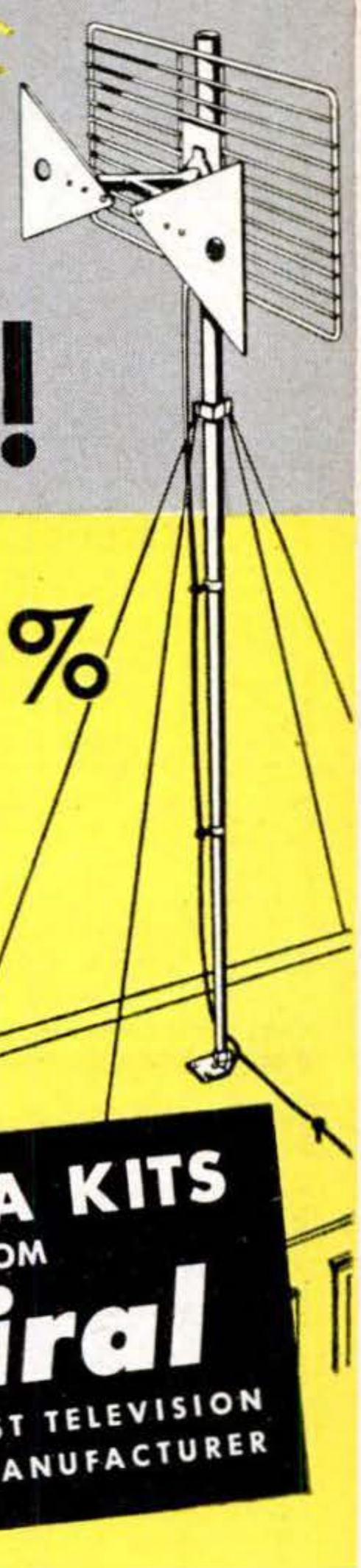

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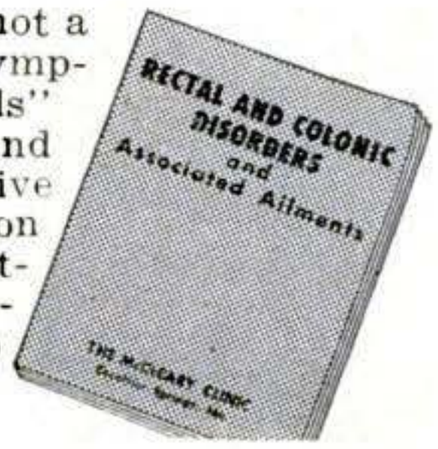

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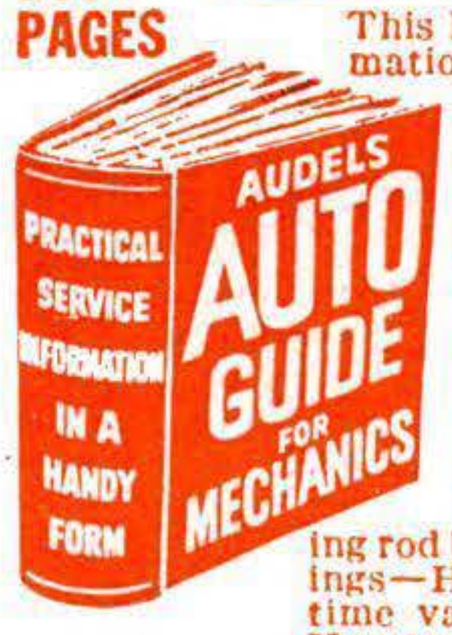

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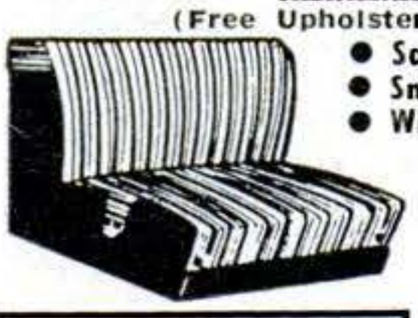

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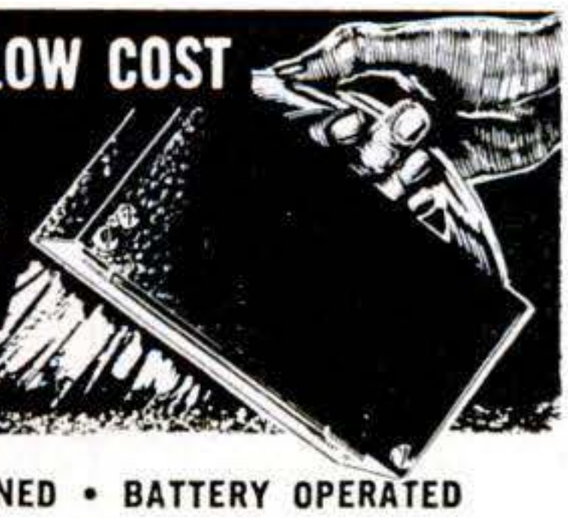

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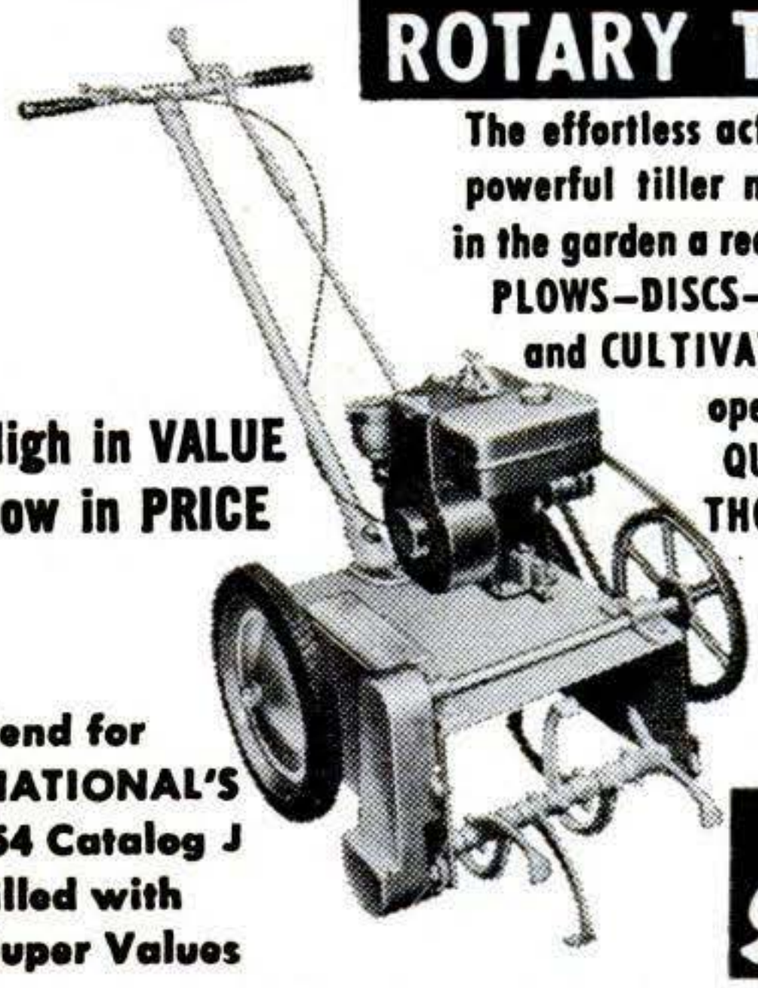

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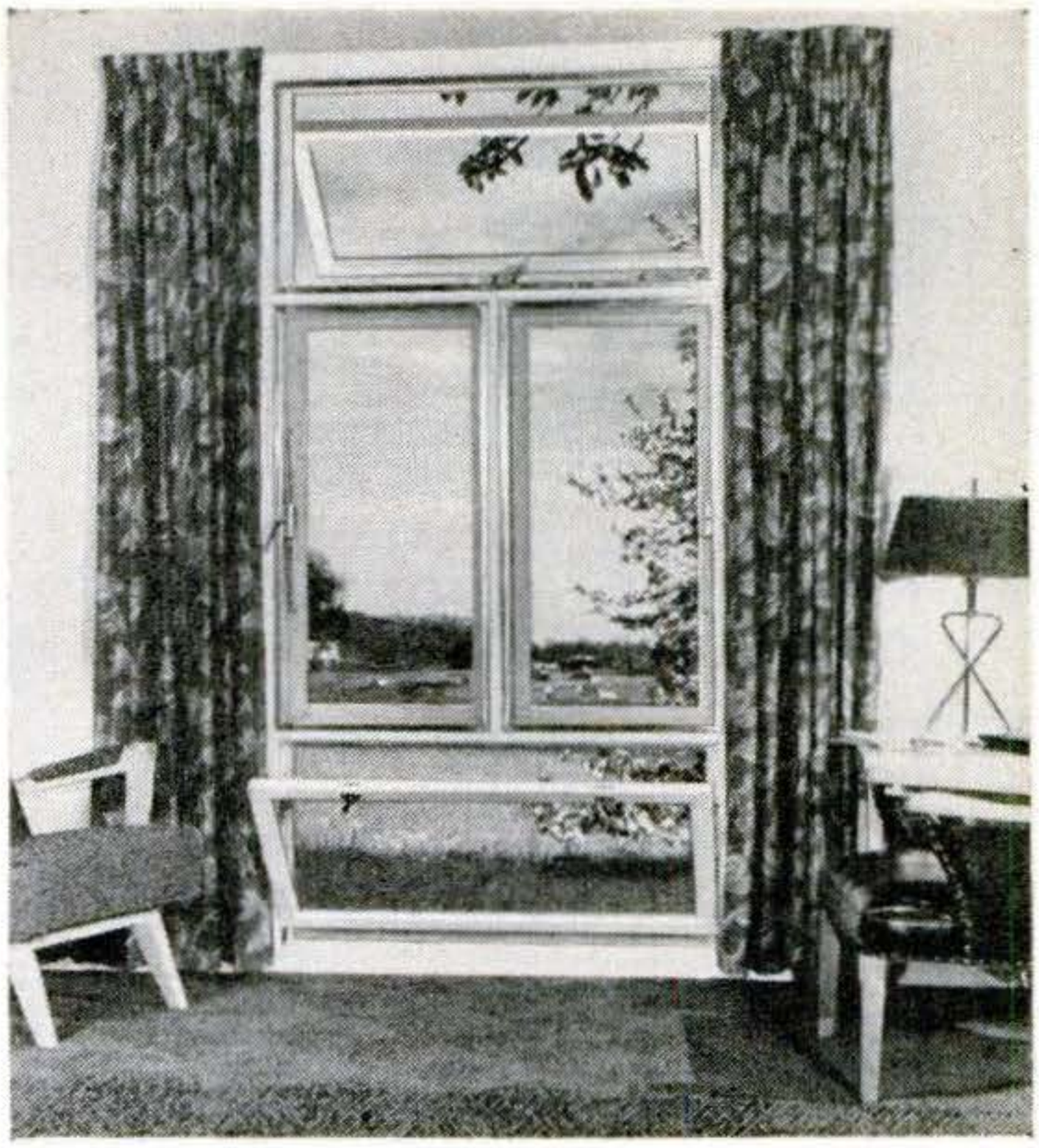

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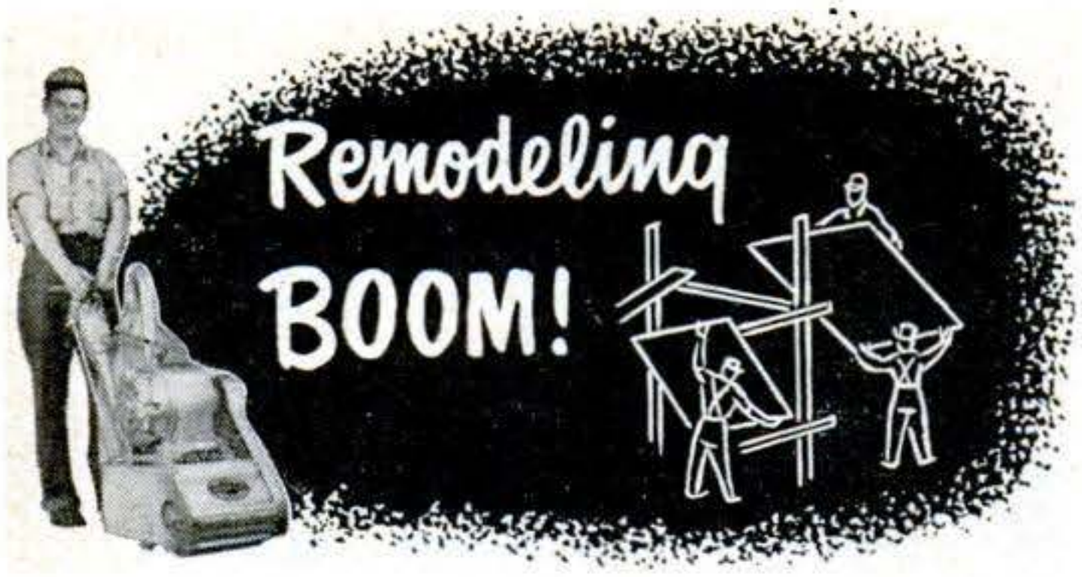

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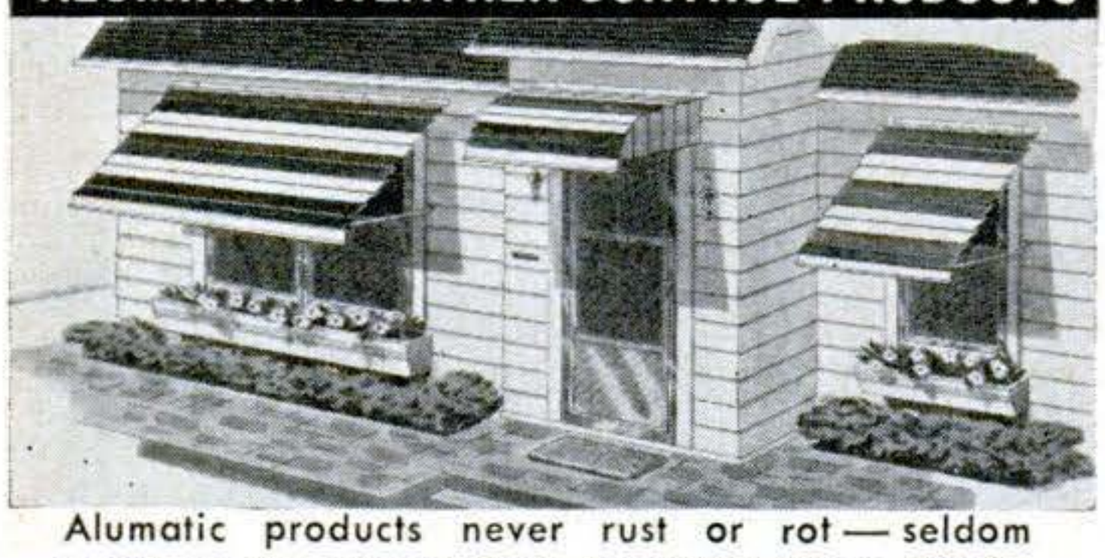

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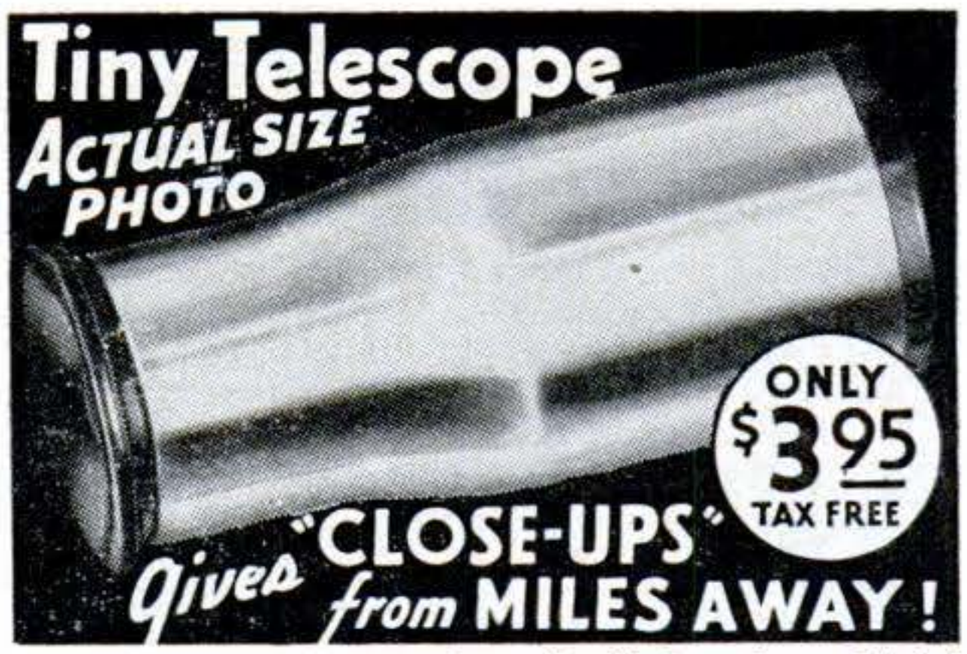

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700-16	6.24	800-15	6.24	750-17	11.84	1000-20	16.84
700-16(6)	7.24	820-15	6.24	600-20	8.24	1100-20	17.84
750-16(6)	8.34	650-15	5.14	650-20	9.74	1200-20	18.84
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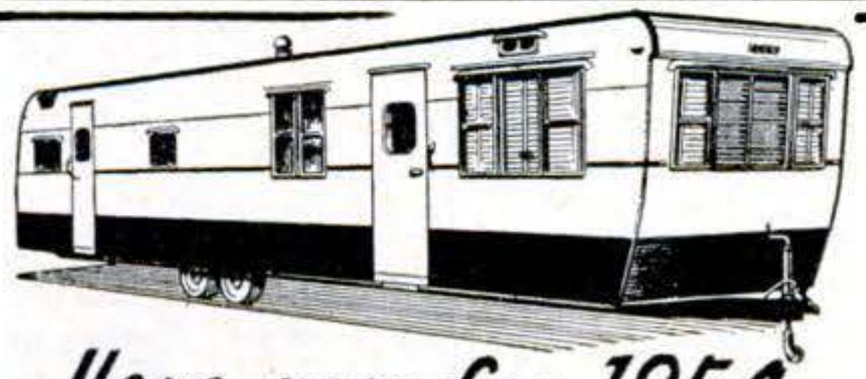

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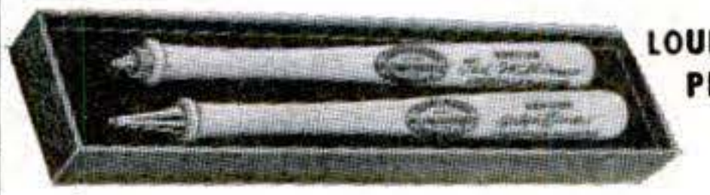

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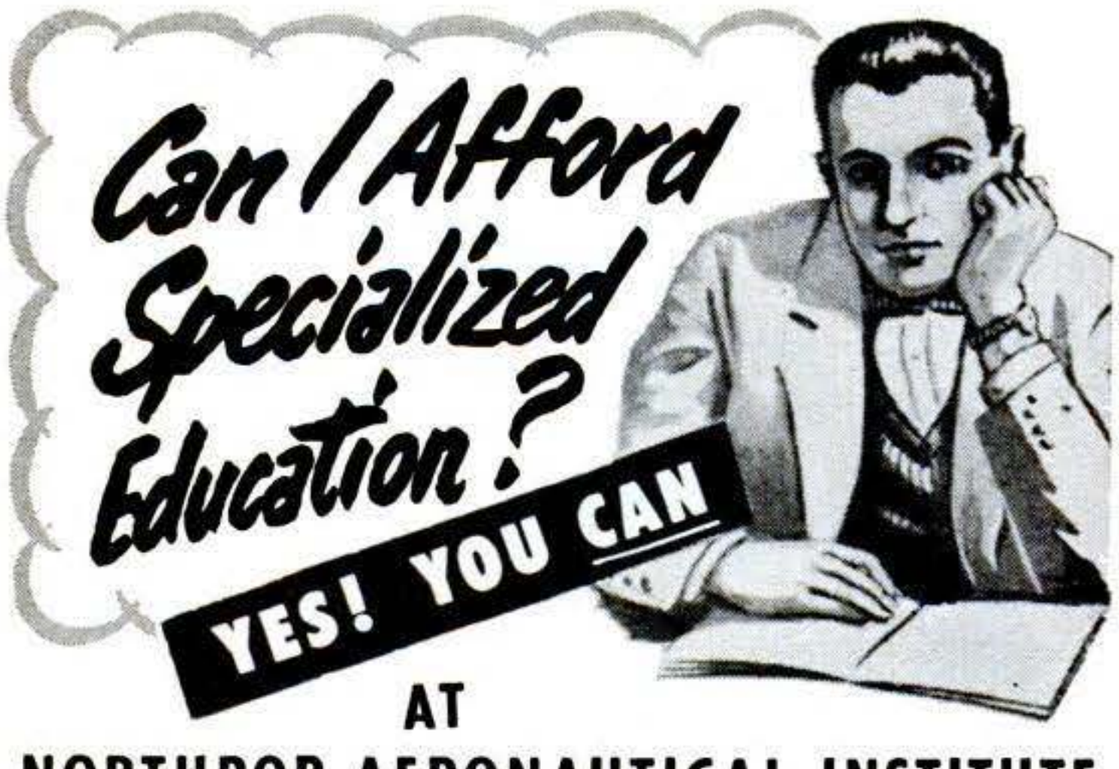

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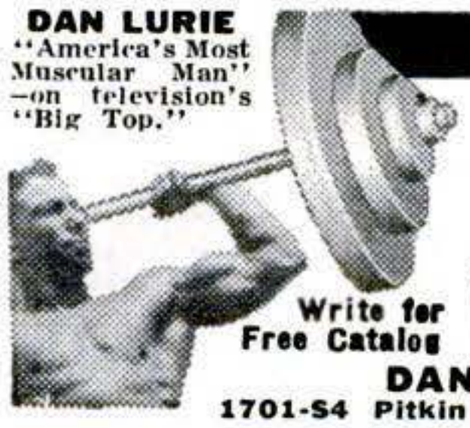

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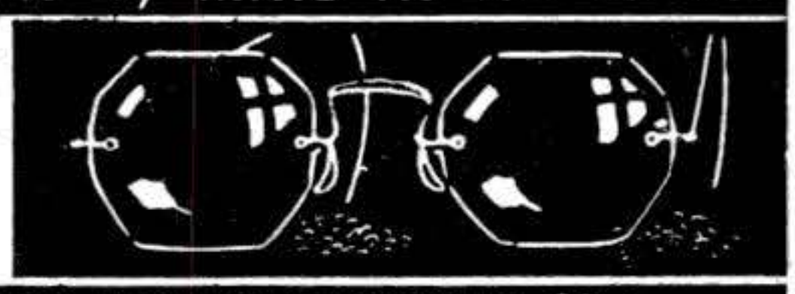

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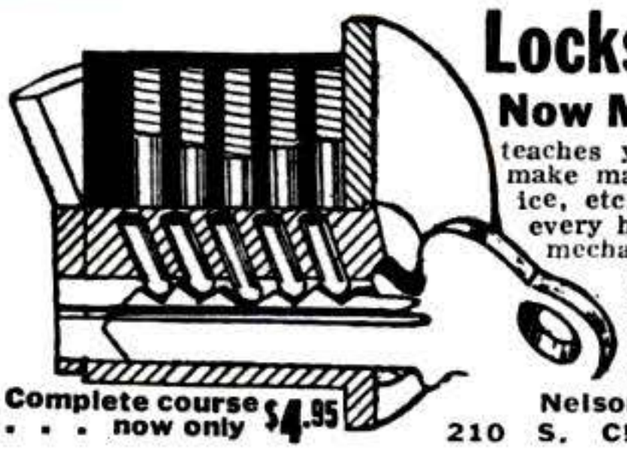

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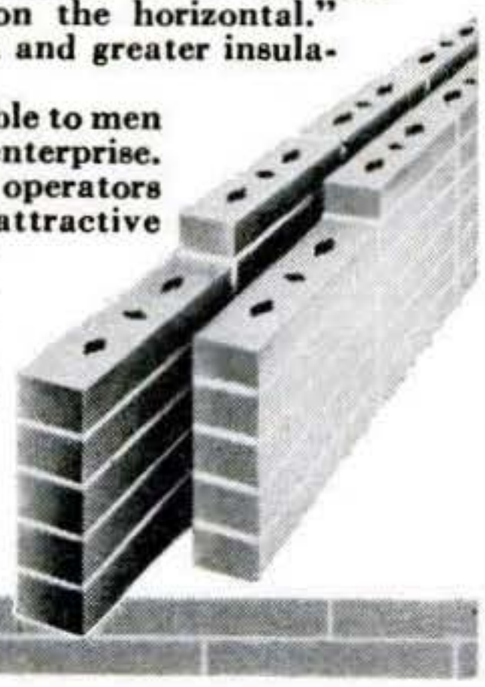

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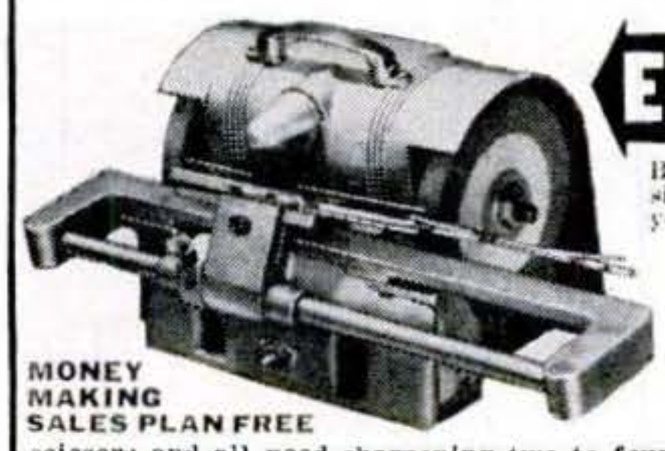

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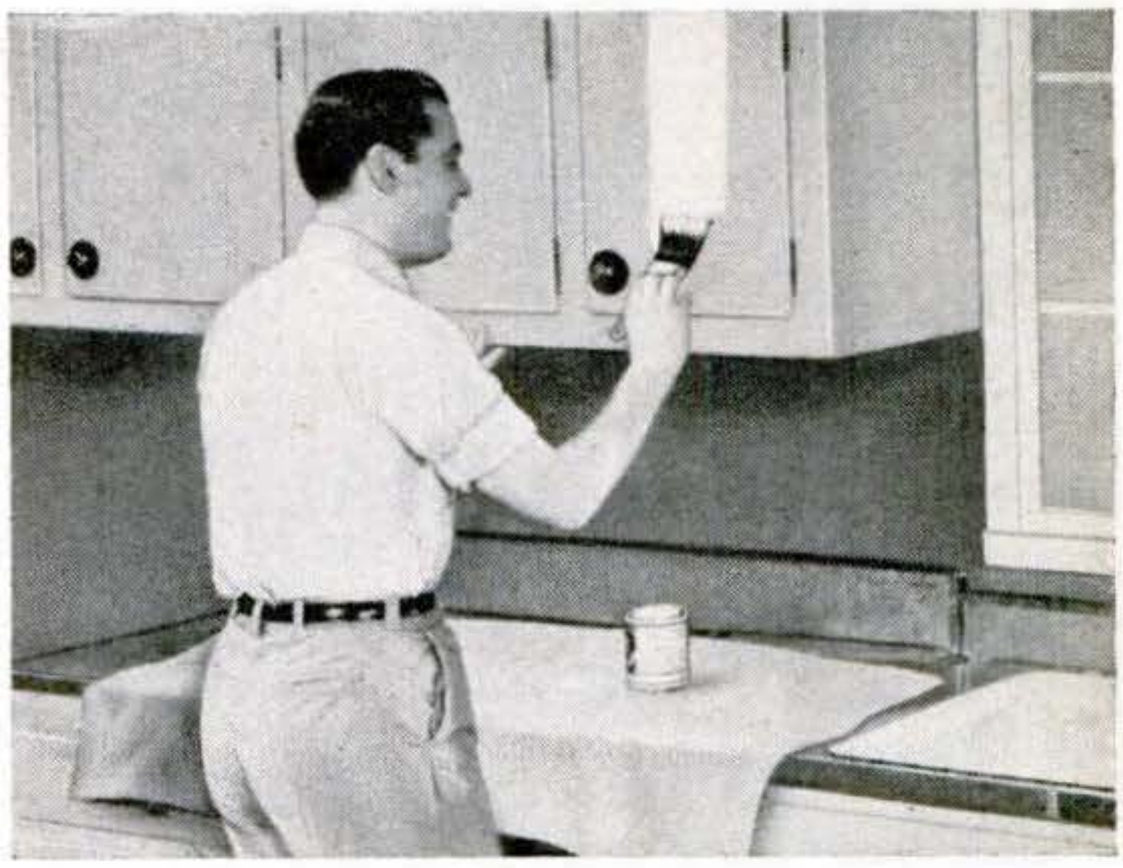

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700-16	6.25	760-15	5.85	750-15	10.85	900-20	17.85
750-16(6)	8.35	800-15	6.25	825-15	11.05	1000-20	16.85
550-18	4.85	820-15	6.25	600-20	8.25	1100-20	17.85
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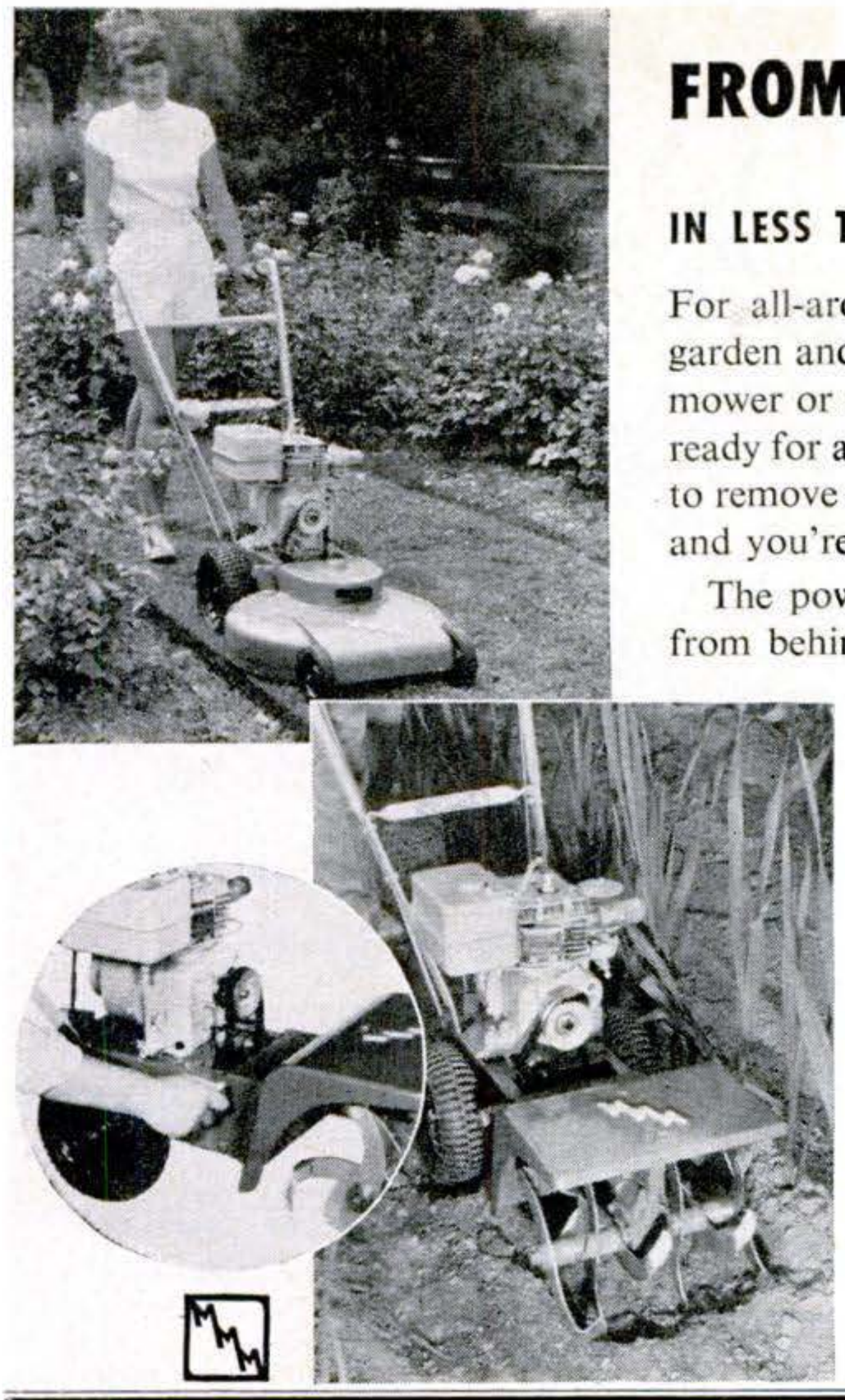

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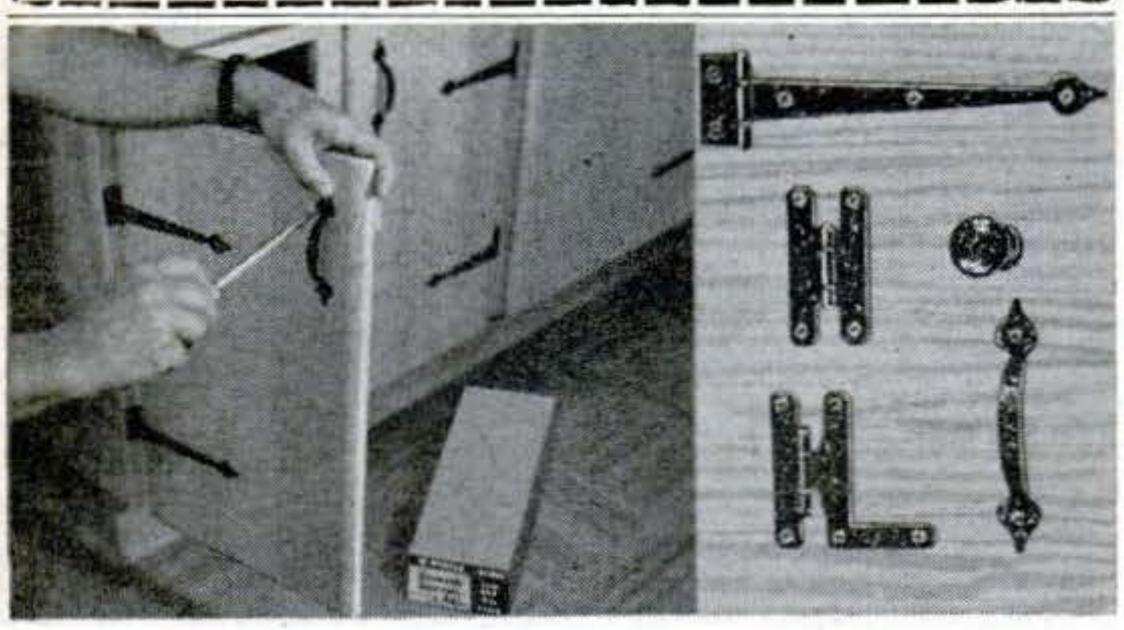

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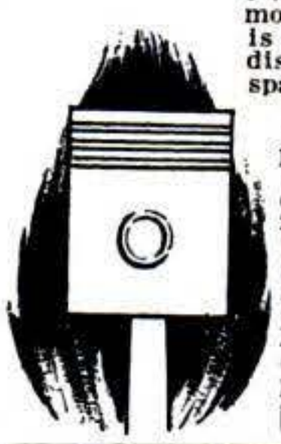

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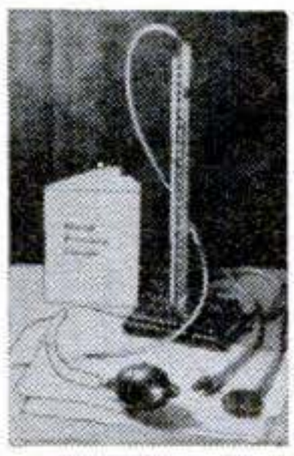

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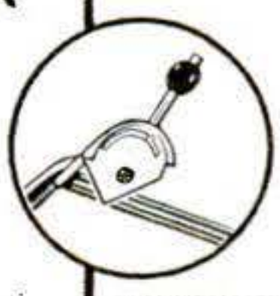

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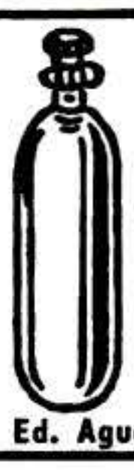

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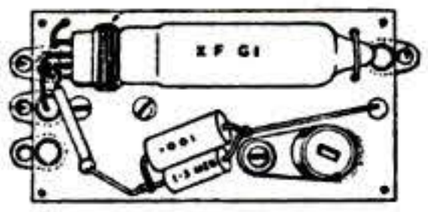

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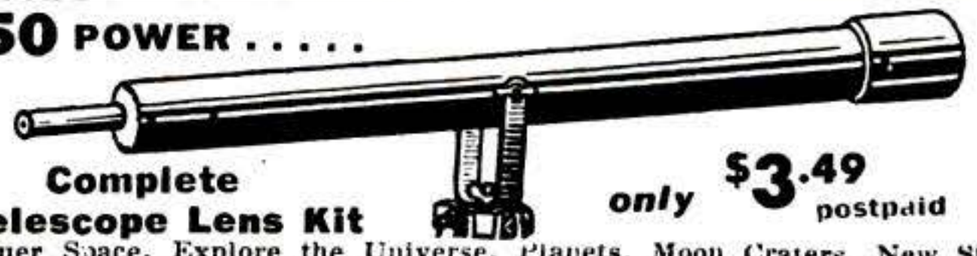

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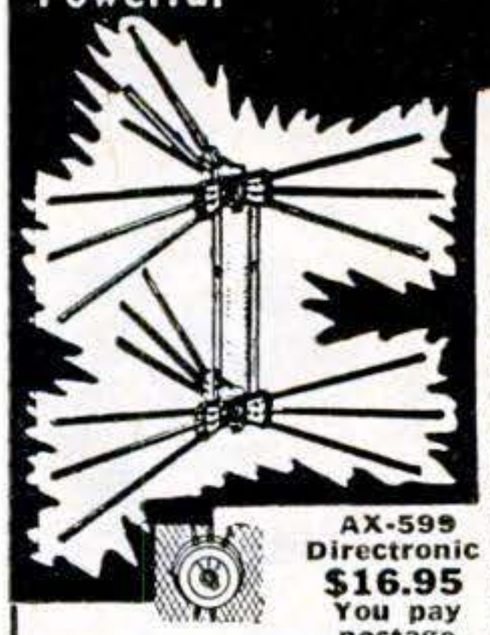

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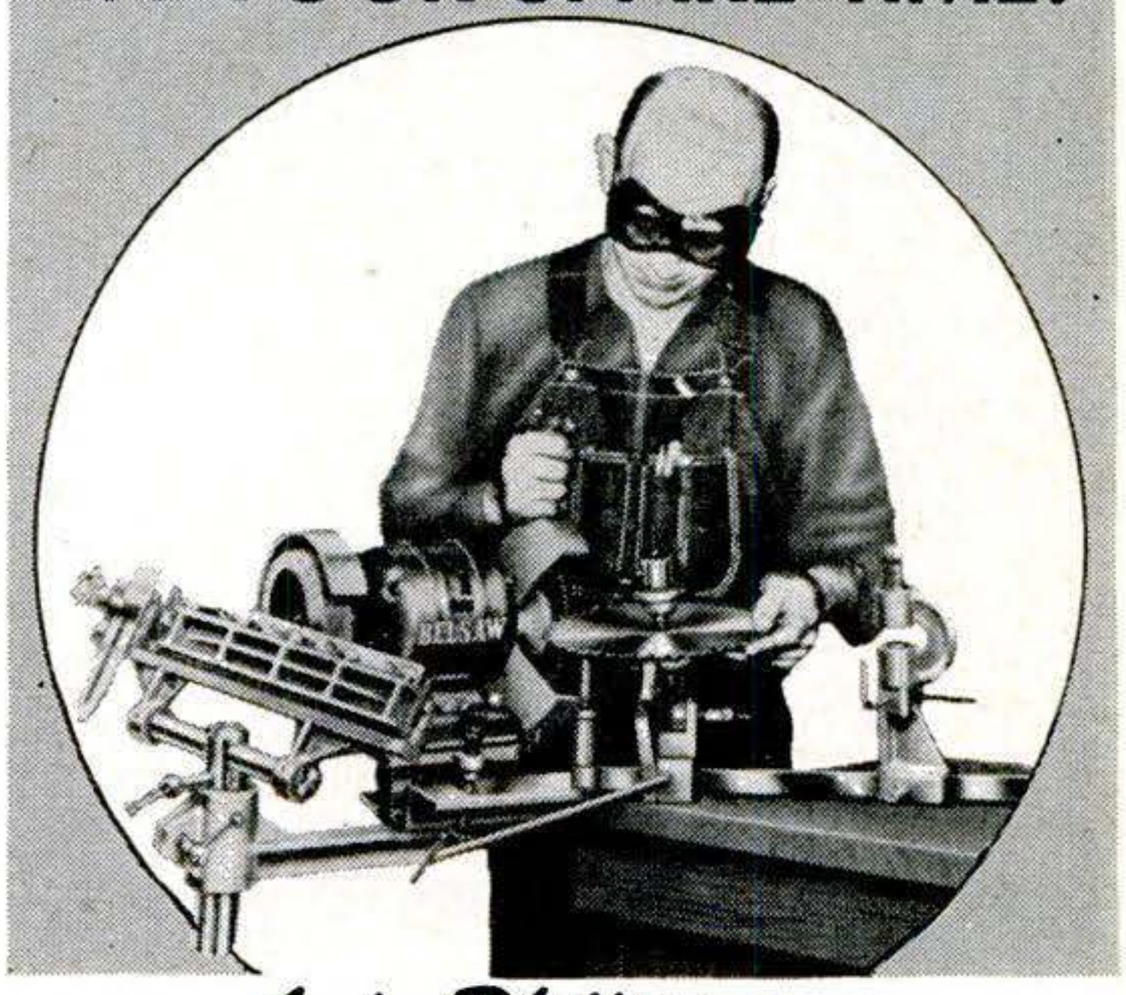

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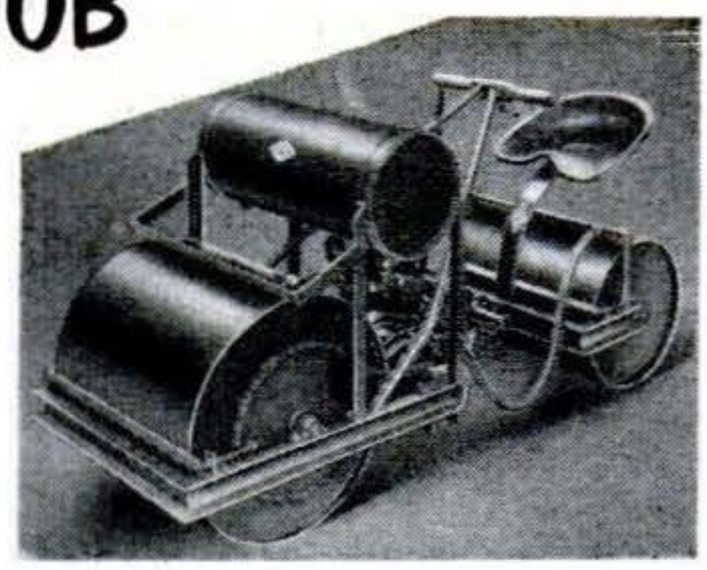

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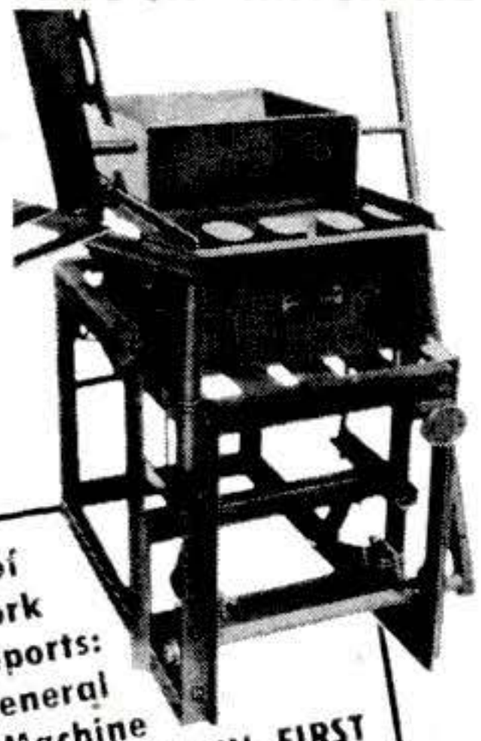

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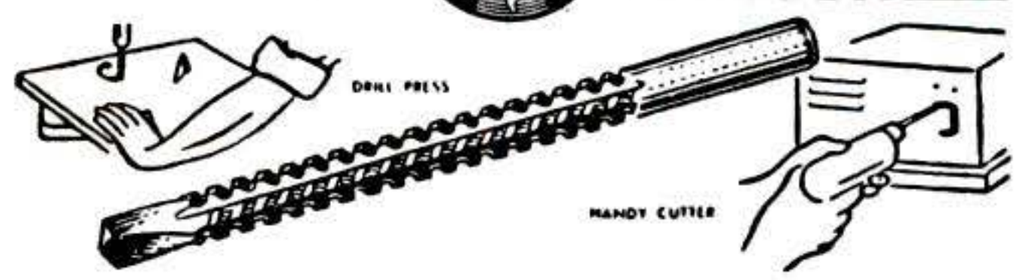

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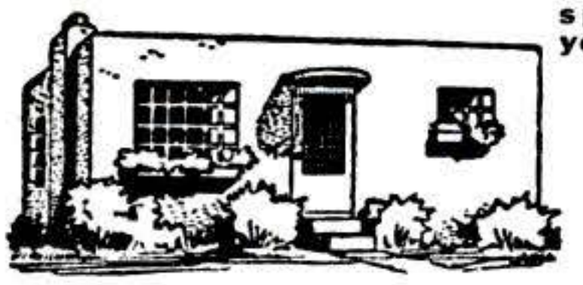

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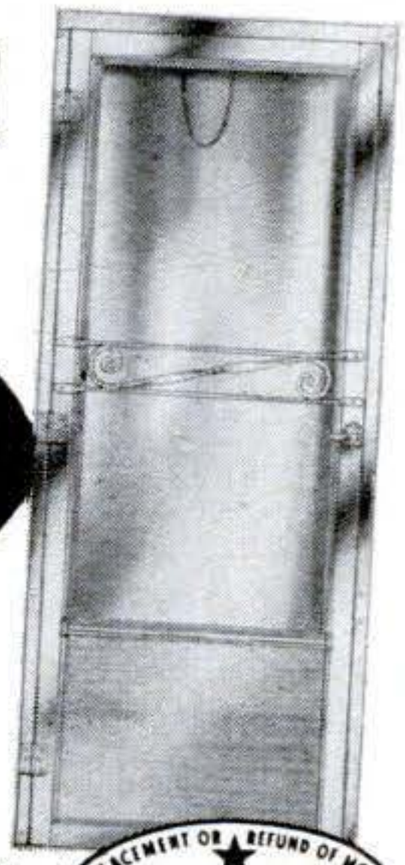

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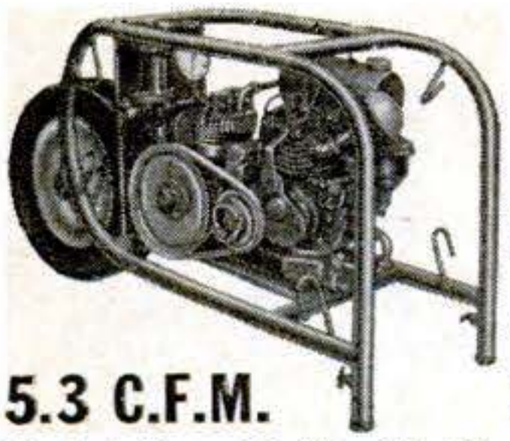

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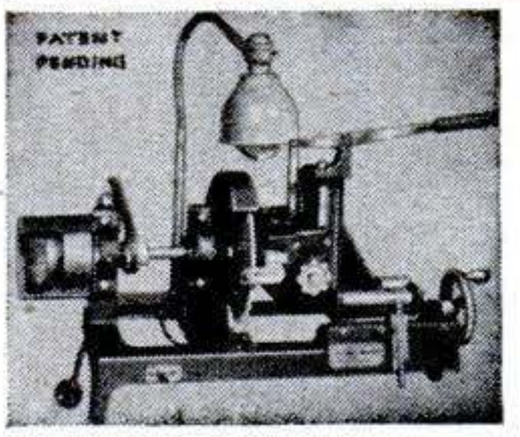

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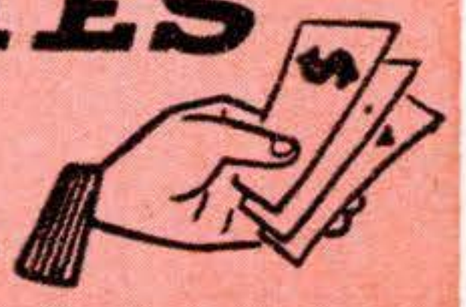

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EARN money making rhinestone jewelry. Rhinestones 50c gross. Catalog. Ebert, Box B183, East Orange, New Jersey.

BUY it wholesale. Manufacturers. Distributors. Over 850,000 items. Literature free. Olsen, 1231-B East Third St., Duluth 5, Minnesota.

MAKE $100.00 Weekly Mailing Merchandise Catalogs, Bearing your name. Sample catalog, details 25c. Products, 526 Western S., Chicago 12, Illinois.

$1000 A Week Possible With Great Triple Profit Plan. Edlkara, Johnstown, Penna.

START your own profitable home mailorder business! We supply everything! Write today! Studio Products, Box 564-"D," Glendale 5, California.

PARAKEETS—$400 month profit from 6 pairs. Spare time. Small space. Breeding information free. Zale, 1024B Bellwood, Bellwood, Illinois.

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AMERICA is still the land of golden opportunities. Fortunes are still begging to be made. Learn how to establish and operate the business of your own choice. Complete business kits only $5.00. Details free. Golden Opportunity Business Kits, 2096 Stanley Ter., Union, New Jersey.

NATURAL molding rubber, extra thick. Free sample. Flock, tinsel candle wax. W. Wooley, 115-B Donald, Peoria, Illinois.

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38 MONEYMAKING OPPORTUNITIES

SELL Titania gems; $9.75 carat wholesale. More brilliant than Diamonds. Free catalogue. Diamonite 1404-S Mitchell, Oakland 1, Calif.

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NEED More Money To Live On? Increase your weekly income $20 to $25 or more in spare time. Supply Rawleigh Products to Consumers. Also openings for full time Dealers. Write Rawleigh's, Dept. D-DD-PSC, Freeport, Illinois.

1930 DEPRESSION forced me to invent my own business—a minimum-cost, high-potential home mailorder. Lucky design paid immediately, over $1,000 every month since! Over half net! This original design, "Selective Mailorder," is United States Postal Service approved. Now mapped out to guide mailorder operators. Literature free. Eveningshade Ranch, Helotes 15, Texas.

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$35 WEEKLY addressing envelopes. Instructions $1, refundable. Adservice, Spring Valley 36, New York.

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ADDRESS advertising postcards. Must have good handwriting. Lindo 504, Watertown, Mass.

OPERATE profitable mail order business write for detail. N. J. Bode, 223 So. Jefferson, Canonsburg, Penna.

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41 CHEMICALS & APPARATUS

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42 HELP WANTED

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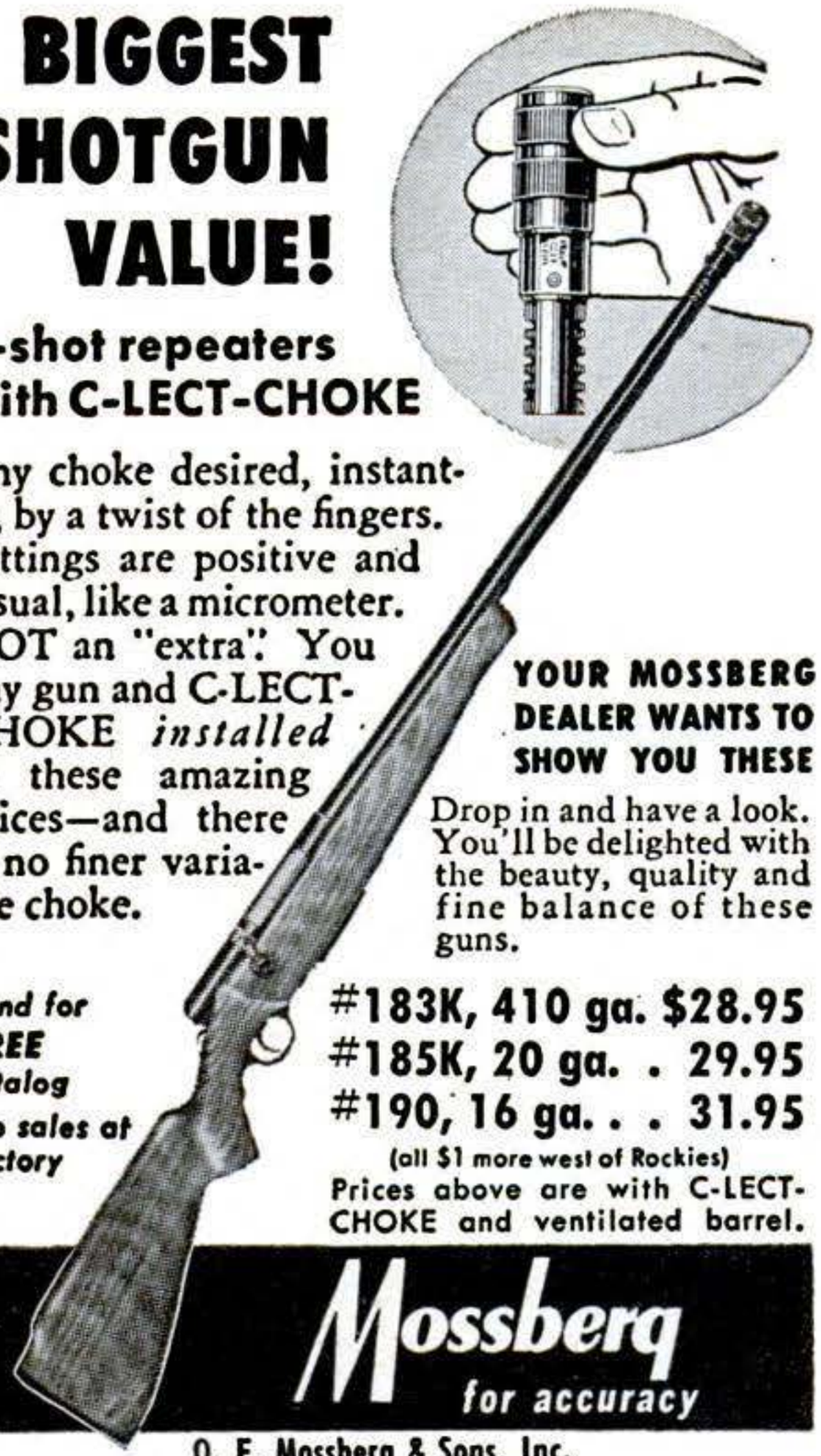

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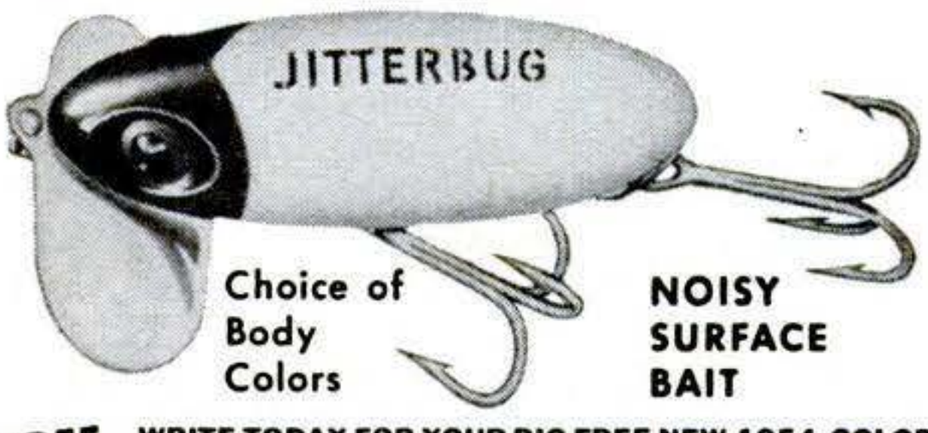

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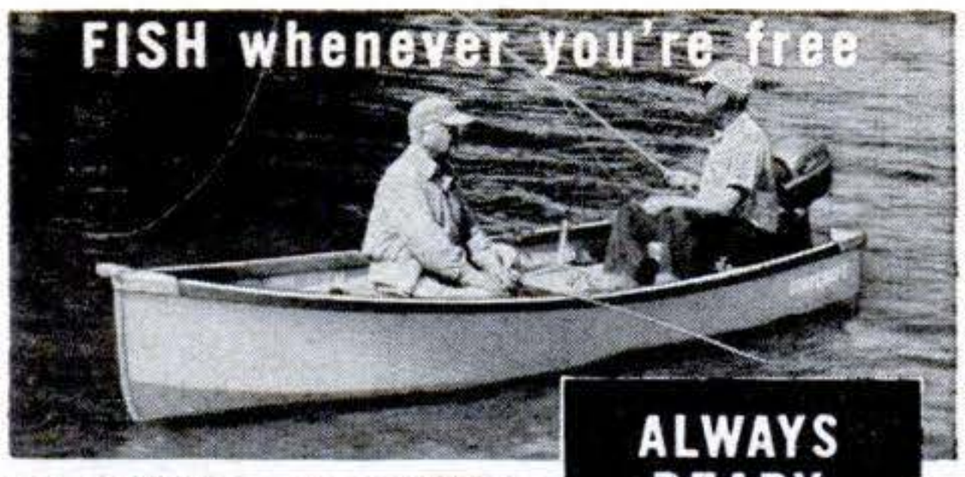

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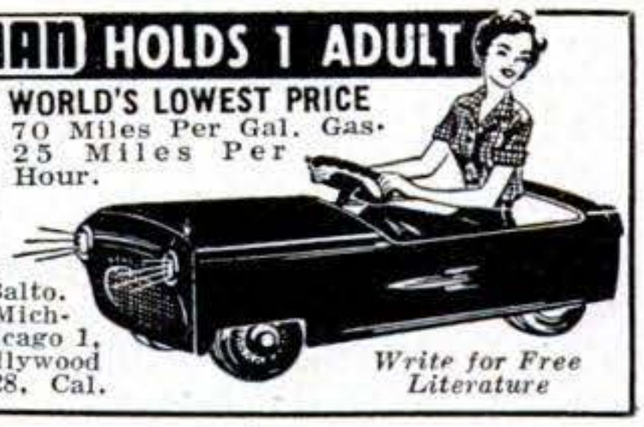

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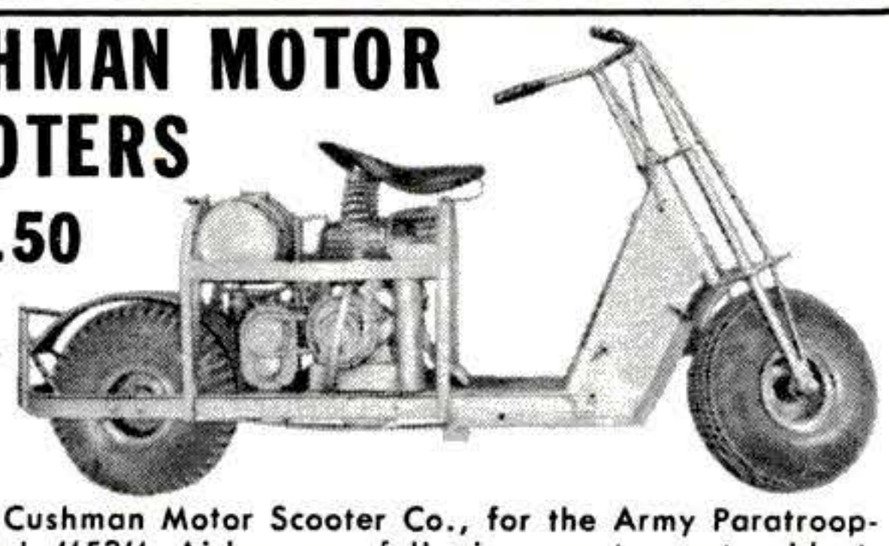
$159.50



Made by Cushman Motor Scooter Co., for the Army Paratroopers, model "53" Airbourne, full size scooter not midget. These surplus scooters have never been used! Just released by the Army. Gov't. cost $454. Weight 255 lbs. 57" wheelbase. 6.00 x 6 tires. Spring mounted leather motorcycle seat. Cushman Huskie one cyl. 4 HP engine. Two speed trans. Built sturdily. Full price $159.50. FOB Hackensack, N. J. Send check or MO with order. Limited quantity—Order now.

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Mine Safety Appliance Co. *Automatic Demand* Regulator* releases air or oxygen only as needed at a pressure identical to that of surrounding water. Heavy, forged, silver-soldered manifold connects 2 high-pressure tanks (295 cu. in. vol.; 22 cu. ft. press. cap.) fitted with easy acting shut-off valves. Exclusive adjustable steel cradle and harness hold tanks in correct position. A special shut-off valve at mouthpiece prevents water from entering hose. Unit is specially designed to stand upright for filling, testing, and storage.

*NOTE—only those self-contained, shallow-water Diving Lungs equipped with demand type regulator are truly automatic requiring *no* chemicals, *no* underwater manipulation.

Complete with following accessories: 2" chrome test-gauge and adapter, chrome wrench, canvas tool bag and instruction manual.

Buy now at this special Early-Season Price Offer: 10% deposit holds your purchase. If C.O.D., require 25% deposit. Send check or Money Order.

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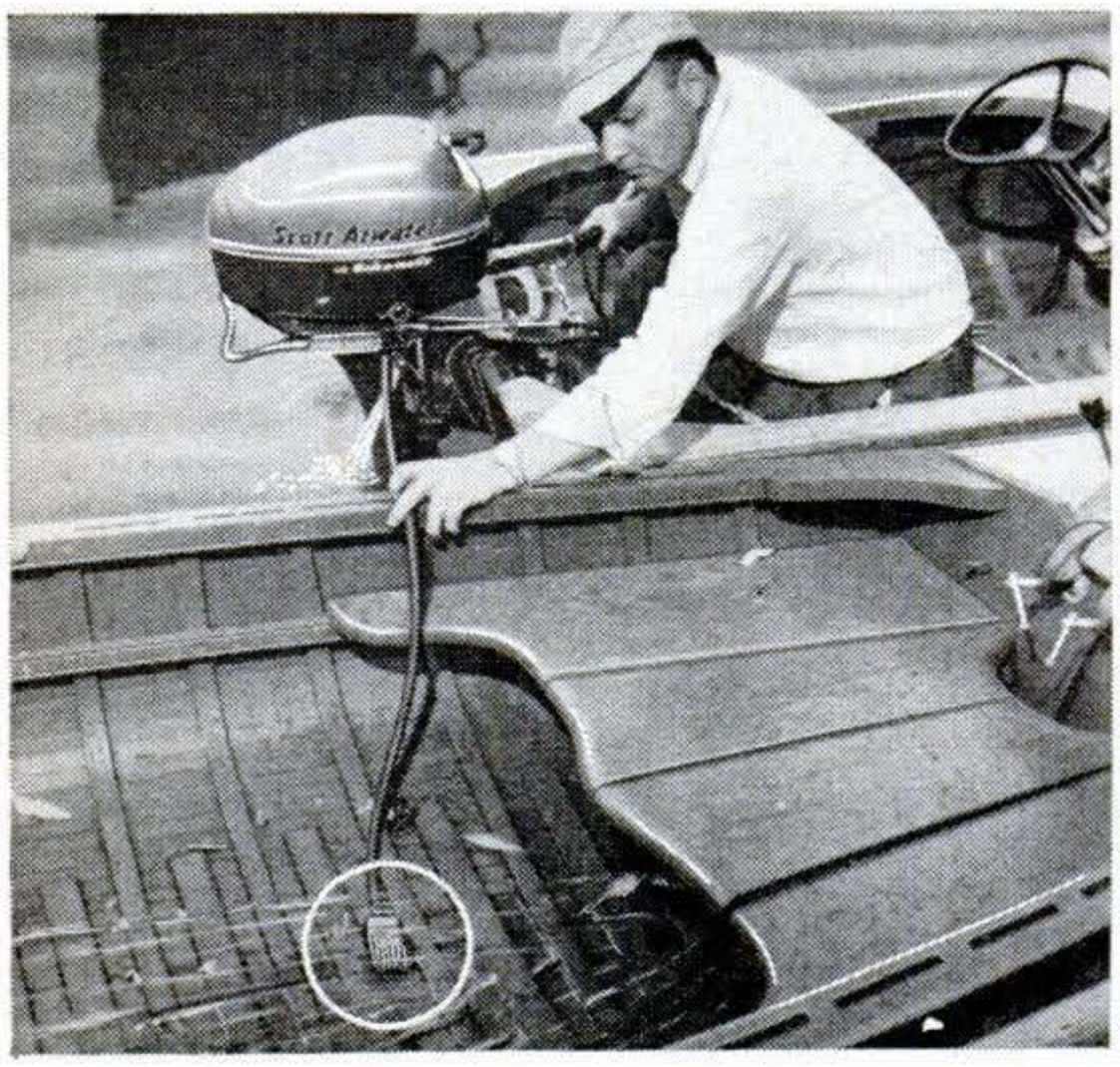
BAILS YOUR BOAT!



SCOTT-ATWATER brings automatic power bailing to outboarding with *Bail-a-matic*, a built-in feature on 5, 7½, 10, 16 HP models at no extra cost! Free booklet tells the whole story. Address Scott-Atwater Mfg. Co., Inc., Minneapolis 13, Minn., Dept. PS-44.

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For you men who know mechanical perfection when you see it. From the moment you make your first cast - you're in for a treat. Beginner or expert, you'll find the NEW Johnson 80 the *one, all purpose* reel. "Nylatron" Drag for smooth action . . . "Change-Easy" Spools for quick line changes . . . true spinning action eliminates line twist.

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MODEL 50-P makes hitching or parking trailers an easy, one-man job. Rides flush. Easily installed. $15.37 complete, Fed. Ex. Tax included, F. O. B. Wausau.

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"As old as the Industry!"
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NEW .25 CAL. BERETTA BANTAM FEATHERWEIGHT AUTOMATIC

Featherweight BERETTA BANTAM in jewel-like satin Chrome finish. Sensational, improved 9 shot automatic pistol. Fits pocket or purse. **43.50**

Deluxe Chrome with Mother Of Pearl Handles Illus.	43.50
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IN PAN-AMERICAN ROAD RACE, "toughest 2,000 miles in the world," thirty leading contenders selected Life-time for their cars, had no trouble, although other cars dropped out due to battery failure. Small stock car winner C. D. Evans said: "most rugged battery I've ever seen."

SCIENCE AND CHEESE CAKE were combined in another test, where Life-time battery was run down completely, then lowered into tank of water and frozen solid. Six weeks later, still in cake of ice, battery was connected to heavy truck motor, started it immediately.

The Battery That Wouldn't Give Up

Run down, baked, frozen, it keeps bouncing back to life. Six-year bonded* guarantee rocks billion dollar industry.

Heralded as the "battery with 753 lives" a new American battery has defied the determined efforts of automotive editors and researchers to make it give up.

Run down, charged, run down and charged from 604 to 1142 times in S.A.E. tests, it keeps coming back for more.

In one test, the Life-time battery beat (by a narrow 24% margin) a famous German battery rumored to be postwar "super battery."

Over 58,000 foot-pounds of power—enough to lift an automobile 15 feet straight up—is developed by the Life-time battery. Tremendous power reserve accounts for battery's performance from 35 below to 160 in the shade.

For cars and trucks, the Life-time battery sells in all 6-volt sizes for $29.95, in 12-volt sizes for $34.95. Special sizes are made for marine and industrial use.

For name of nearest dealer or distributor, write Continental Manufacturing Corporation, Dept. PS-4, Washington Blvd. at Motor Ave., Culver City, Calif.

**Six-year guarantee backed by multi-million-dollar bonding company.*

WANTED: Life-time Battery Distributors, Dealers, Regional Managers

Frankly, we have a problem. Every day, letters and wires pour in asking for the name of the nearest Life-time battery dealer—so many, in fact, that we need more dealers to handle the demand. **These new customers** have seen our full-page advertisements in **Look, True, Argosy, Esquire** and about thirty other magazines. Or they have seen or heard our television and radio broadcasts of international sporting events like the Pan-American Road Race. Now, the same mail brings requests for Life-time battery dealerships.

The answer seems simple: appoint these dealers to take care of our new customers—but it isn't that easy. We need men with executive ability who can qualify as regional managers to help us decide which dealers should be appointed in the fastest-growing organization of its kind in the world. We also need distributors to handle warehousing and administration for our dealer network. If you have organizational ability and are financially responsible, we'd like to hear from you and discuss your opportunities with us.

Continental Manufacturing Corporation, Dept. PS-4, Washington Boulevard at Motor Avenue, Culver City, California

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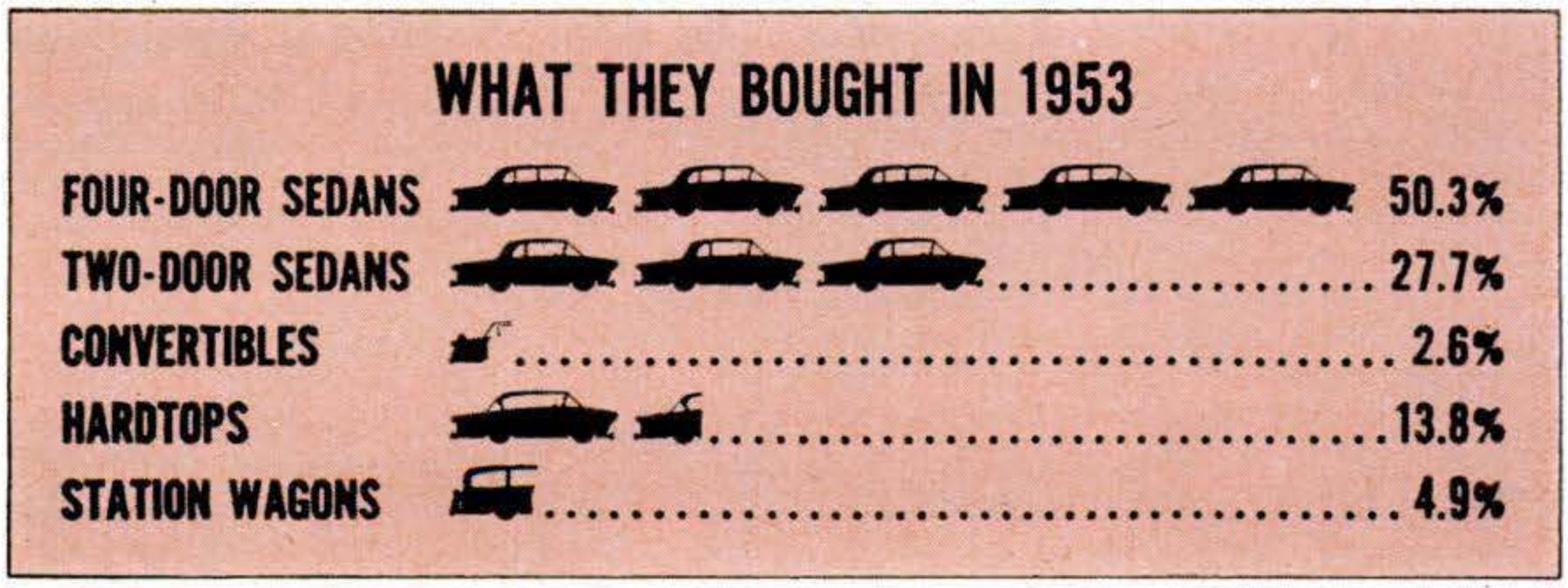
POPULAR SCIENCE MONTHLY'S . . . Last minute news & notes

THE ATOM SUB NAUTILUS IS CONTROLLED BY A JOY STICK like the ones used in airplanes. With it, one man can steer and adjust bow and stern for diving, jobs that in other submarines take three men.

BIG-SCREEN COLOR TELEVISION should be available in a few months. RCA has announced development of a 19-inch viewing tube with nearly double the picture area of the 15-incher now in production . . . Blown fuses may harry many pioneer color-TV fans. The first color receivers consume nearly twice as much power as black-and-white sets and may be the last straw for house circuits already heavily burdened with appliances . . . Round rubber bands--they're easier to pick up and sort--are being made by Goodrich. . . . An ultraviolet-ray water purifier for use with private wells has been developed. It operates automatically when connected to the water pipes, is smaller than an electric toaster. A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill., makes it.

THE OLD RELIABLE FOUR-DOOR SEDAN is what more and more people buy, no matter how lovingly they eye the flashy convertibles. Last year's sales figures, just released, show that more than half the cars bought were family sedans (see chart below), up from 42 percent in 1940. The business coupe has almost gone the way of the phaeton--it accounted for only .6 percent of sales in '53 . . . A new torque converter working backwards brakes big trucks going downhill. It gives the wheels "made work" by using a rotor connected to the transmission to pump oil. The driver controls the Allison Torqmatic Brake by varying the flow of oil into the unit.



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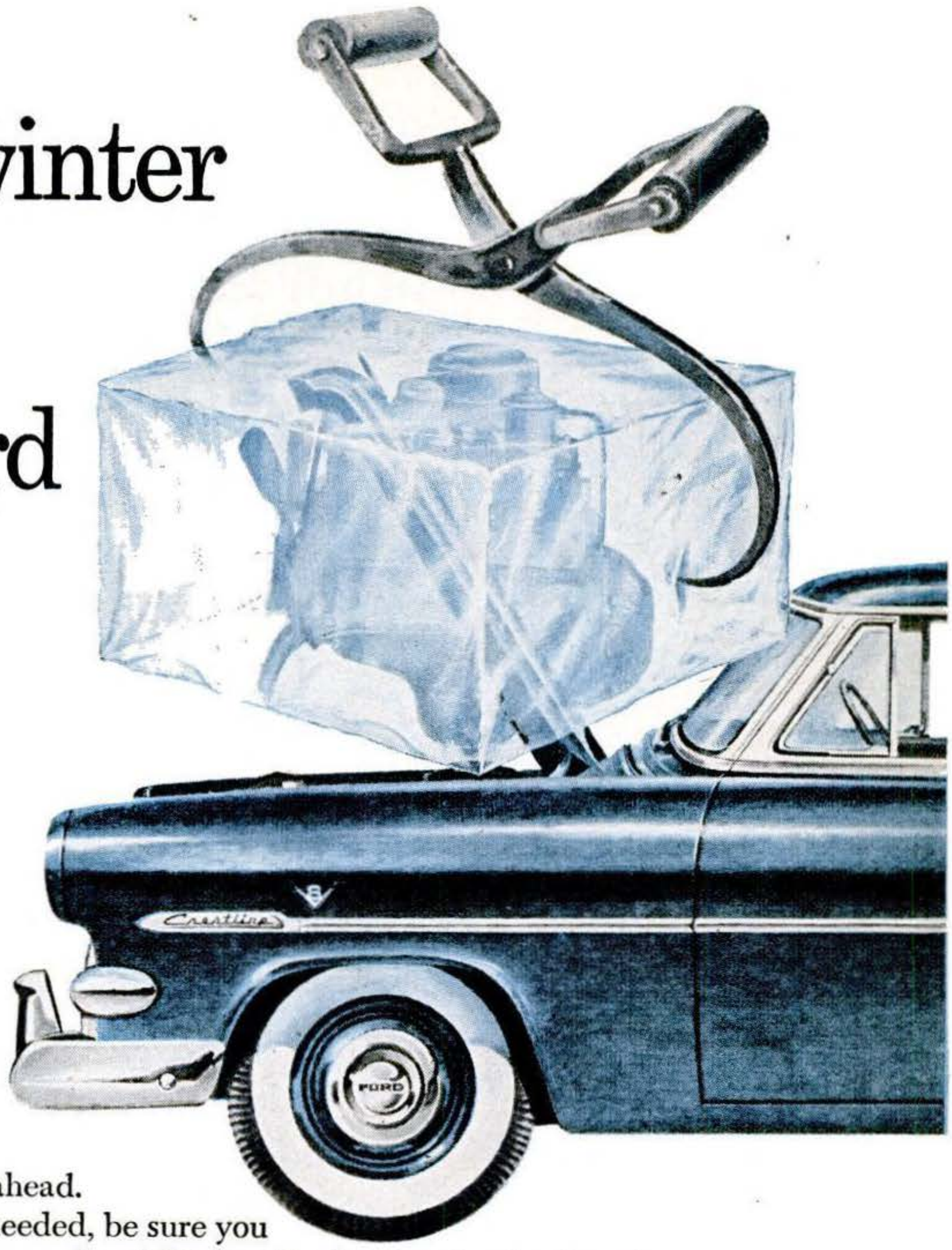
Lift winter out of your Ford

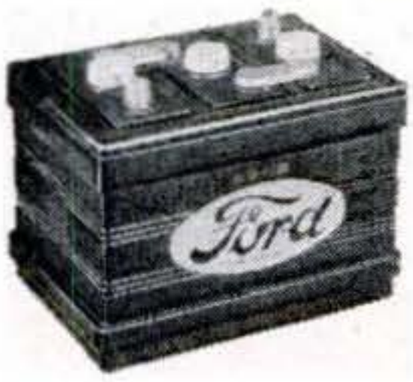


Winter gives your Ford the severest treatment it gets all year. So with the coming of spring, it's time to have your Ford thoroughly checked and made ready for the pleasant driving months ahead. And if replacements are needed, be sure you

get the parts that are made *right* for Fords—to standards set by the same men who built your Ford—Genuine Ford Parts.

FORD Division of FORD MOTOR COMPANY

Ford Batteries



Long-life Ford batteries are tailored to Ford's ignition requirements and your dealer can recommend the *right* capacity Ford battery for *your* Ford. And every battery carries a liberal warranty.

Ford Spark Plugs

Ford Spark Plugs with unique Sillment seal are designed to "seal in" compression, keep power high. Balanced to your Ford's ignition needs, they give smooth performance, high gas mileage.

Ford Oil Filter Elements

Specially designed filtering material, with millions of tiny pores, screens out harmful contaminants, quickly, thoroughly...yet oil flows freely for proper lubrication; useful additives are retained.

Ford SERVICE

"Trade" where you see these signs

GENUINE Ford PARTS

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"Traffic or track . . .

I USE CHAMPION SPARK PLUGS BECAUSE WEAK PLUGS WASTE POWER AND MONEY!"

says Sam Hanks

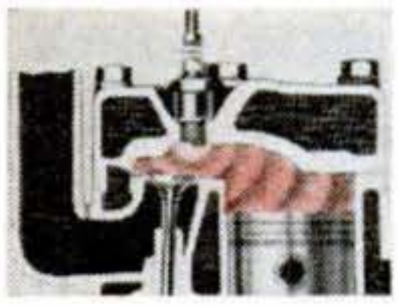
1953 AAA DRIVING CHAMPION

If faulty or weak spark plugs are robbing *your* car of gasoline economy, then take the sound advice of Sam Hanks—named by the American Automobile Association as 1953's top driver.

"Full-firing Champions' steady spark puts every drop of gasoline to work delivering better car performance and economy. That's why I use Champions exclusively in racing engines and in my family cars. You can depend on Champions to give you *all* the power you're paying for!"

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

HERE'S WHY YOU NEED CHAMPIONS:



INFERIOR OR WORN-OUT PLUGS waste gasoline by failing to ignite all the gas in the combustion chamber. Unburned gasoline goes out the exhaust.

PRECISION-BUILT CHAMPIONS give a full-firing spark which burns all the gasoline in the cylinder and turns it into useful power.

CHAMPIONS

WILL MAKE ANY CAR RUN BETTER

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POPULAR SCIENCE
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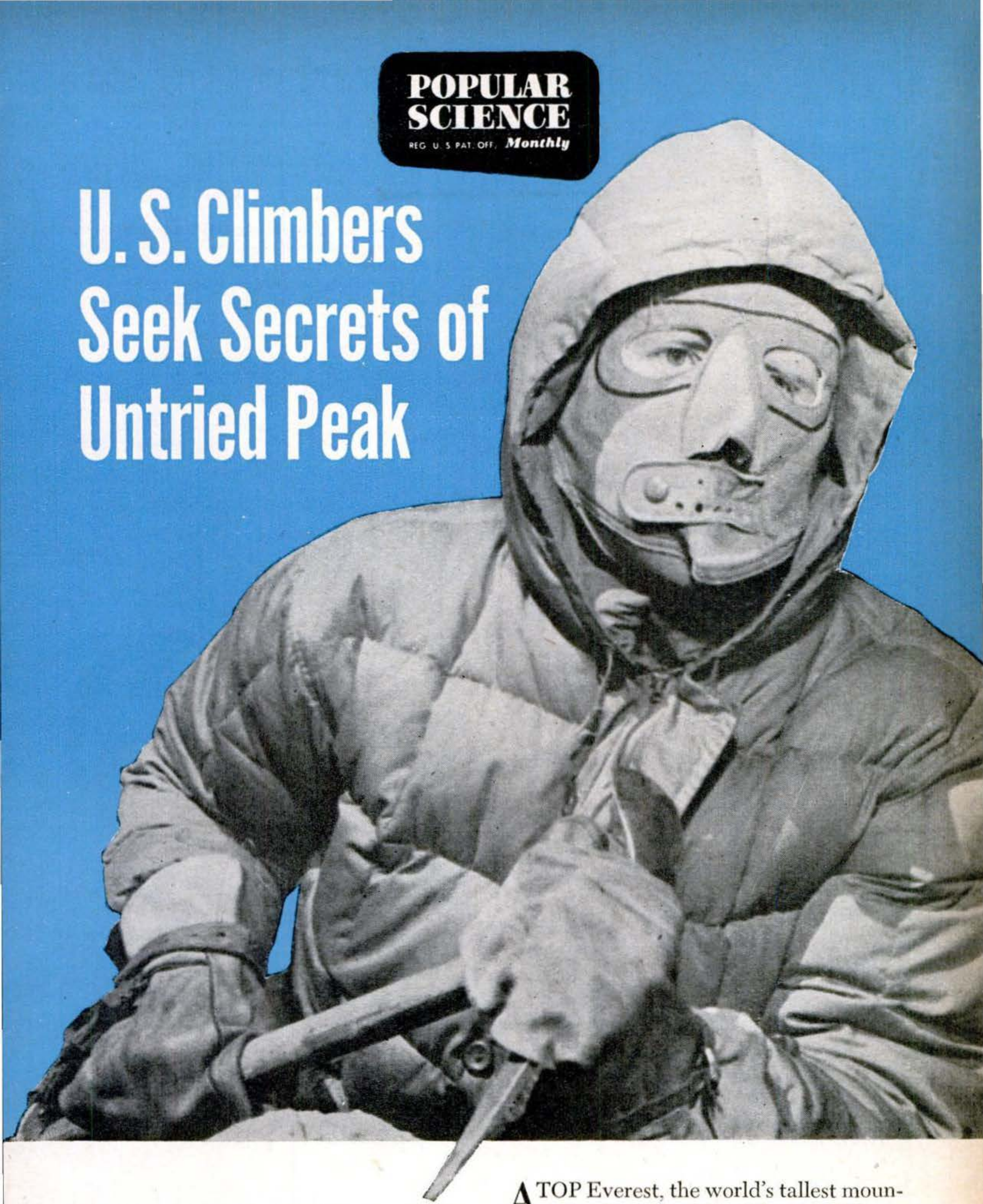
U. S. Climbers Seek Secrets of Untried Peak



California scientists assault Everest's giant twin to learn why mountains wear out men.

By Gardner Soule

ATOP Everest, the world's tallest mountain, last May 29, Edmond Hillary and Tensing Norkay looked around them at the pinnacled vista of the Himalayas. "To the east," Hillary recalled later, "was our giant neighbor Makalu, unexplored and unclimbed. I wondered whether a

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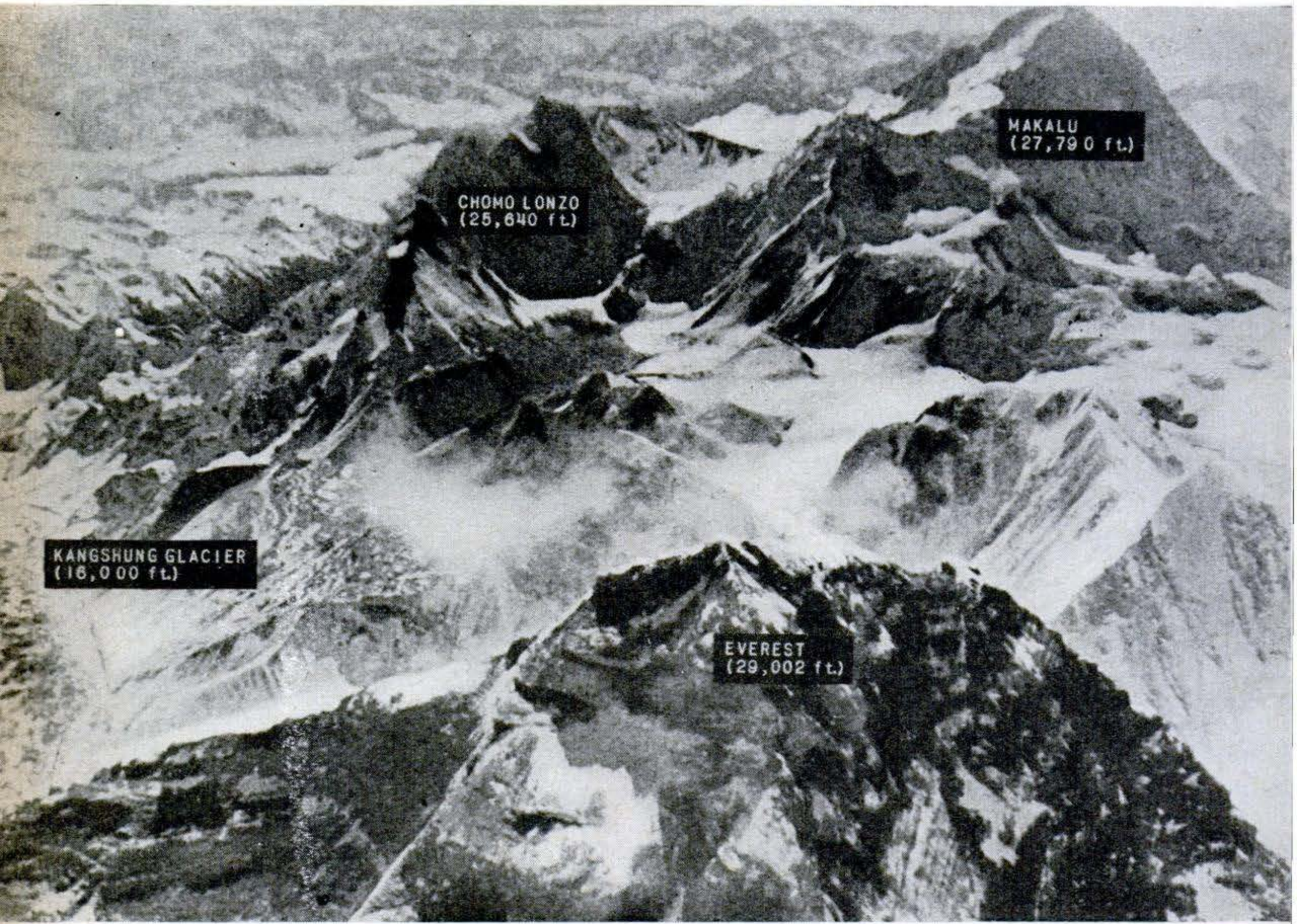
READY FOR THE BIG TEST on Makalu's terrifying slopes, these four Californians (left) who will make the climb have already trained hard in the Sierras, Andes and on Alaskan and European peaks. Left to right: Fritz Lippman, Alfred Baxter, Richard Houston and Allen Steck.

CUPOLAS ON THE WORLD'S ROOF (below), seen from an airplane, include Everest, Makalu and Chomo Lonzo. The camera faced east-southeast. Tibet is at the far left, Nepal at right.



route up that mountain might not exist."

Makalu, 12 miles from Everest, 27,790 feet tall (only 1,212 feet shorter than Everest itself), is the world's fourth highest mountain.

To see if there is a route up it, 10 men from California are poised at Makalu's base, about to begin the ascent. But the question of a route is only a small mystery compared to the big puzzle the Californians want to solve. They want to find out why the high Himalayas—Everest, Makalu and the others—are so hard on men. They want to learn what really happens inside a man when he is subjected to great stress.

The mountaineer on the upper slopes of Everest, says Eric Shipton, the great British Himalayan explorer, is "like a sick man climbing in a dream." At the peak of Everest, Hillary was only slightly tired; by the time he reached the first advanced camp, coming down, he was utterly exhausted.

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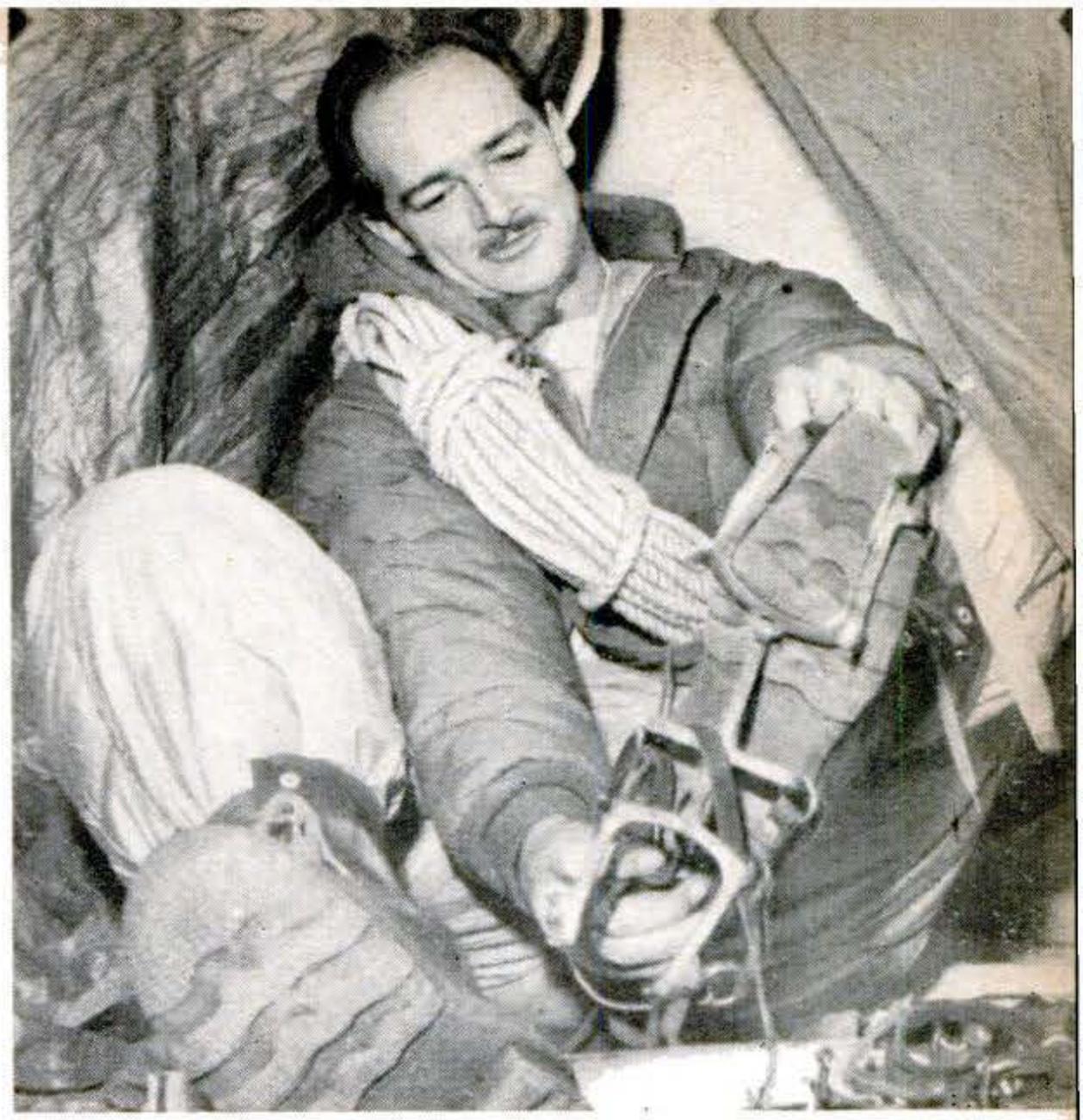
This desperate fatigue is only one of the results of severe emotional and physiological stress. Mountaineers report many other results: headaches, nausea, loss of memory, loss of temper, loss of appetite, enlargement of the heart, gasping for breath. These are caused by body changes that take place under conditions of physical hardship and mental strain. Little is known about the specific physiological changes involved; through study of these, it is hoped that the mechanism of stress itself will be better understood.

Tests on the Top of the World

Filling this gap in scientific knowledge is the great objective of the expedition to Makalu. The leader, William E. Siri, 33, is a medical physicist. Dr. Nello Pace, 37, oldest man in the party and an associate professor of physiology at the University of California, is senior scientist of the expedition, in charge of the research on stress.

Throughout the climb, Siri and Pace will be hard at work: measuring the white-blood-cell count and the eosinophile (another blood cell) count of men on the expedition; taking blood smears for study; analyzing samples of blood for urea, nitrogen, sodium and potassium; making gravity, sodium and potassium determinations of urine specimens; measuring the adrenal-cortical reserve—the amount of hormone still available to the body after stress; and measuring certain sterols (body alcohols) eliminated in the urine.



CRAMPONS TO BITE INTO ICE or packed snow are fitted over boots by Fritz Lippman of the Makalu expedition. The climbers fear bare rock, which would offer riskier footholds.

Other frequent tests made upon climbers will include red-blood-cell counts, tests of hemoglobin concentration, checks on the rate of breathing, and counts of pulse rates of men at rest and after simple exercise.

Men can be placed under stress in many ways besides high mountaineering: a death in the family, a business failure,

[Continued on page 266]

ORDEAL BY HEAT in the steamy Arun River valley, infested with malaria and giant hornets said to inflict fatal stings, had to be endured before the climbing even began.

ORDEAL BY FATIGUE—its cruel drag on Everest conquerors Hillary and Tensing evident in photo below, taken near the top of their climb—awaits Makalu expedition.

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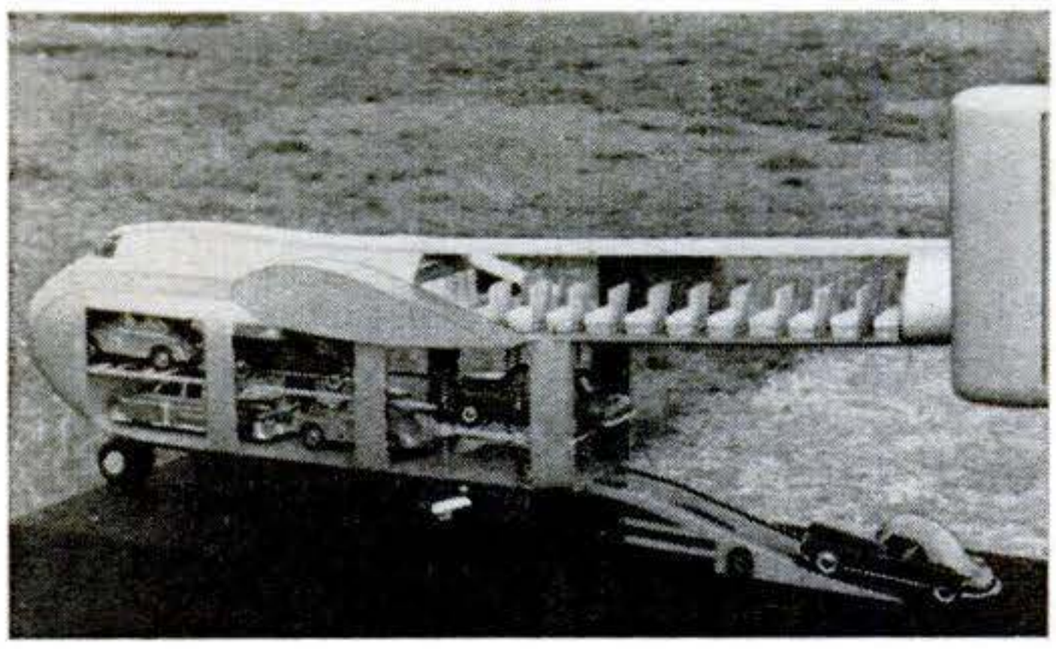
Three-Deck Aerial Auto Ferry Now Hops English Channel

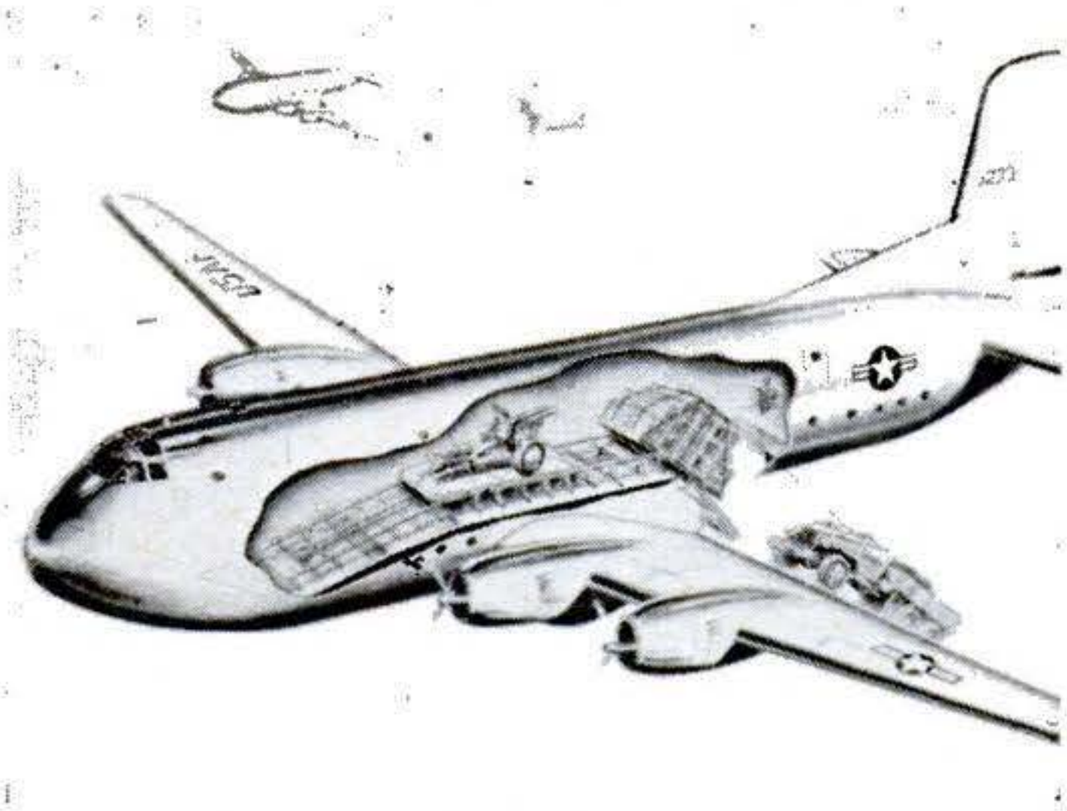


A LONDON passenger and his car are now only 85 minutes away from Paris. A 42-ton, four-engine Blackburn Beverley freighter of the Silver City Airways regularly ferries 42 passengers and six automobiles across the English Channel at more than 175 miles an hour.

The cars are loaded onto a double cargo deck through the rear of the plane's fuselage (see model at left). An electric elevator lifts three of the cars to the upper deck.

Fast Copter Carries Jeeps

THE Marines' new helicopter can stow three Jeeps in its fat fuselage. Two engines, encased in teardrop compartments, give the Sikorsky XHR2S a speed of 150 miles an hour—fast for a whirlybird. Retractable landing gear lends the big aircraft a streamlined look in flight. It can carry 26 men, fully combat-equipped.



Plane Drops Big Stuff Pronto

PARACHUTE delivery of a field piece, several hundred rounds of ammo and a truck takes no time at all with a new system installed in an Air Force Douglas C-124 cargo plane. Each unit is lashed to a pallet, on tracks and hooked to a chain drive. At the touch of a switch, 40,000 pounds of cargo can be dumped in a few seconds.

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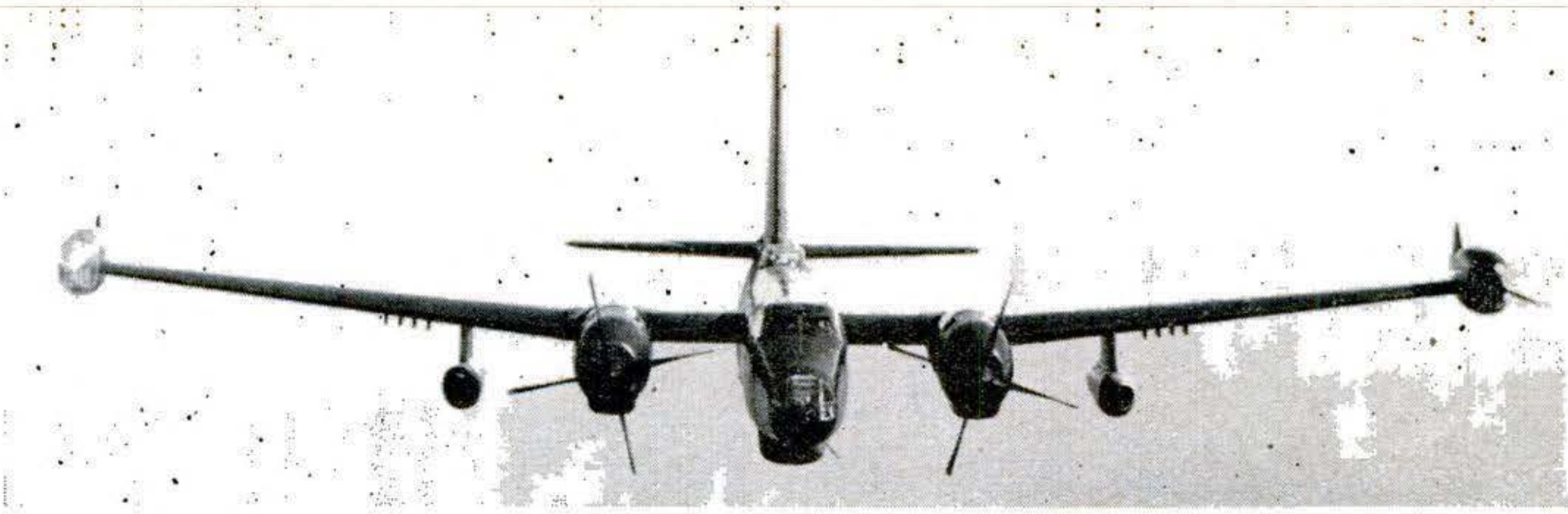

Jet Assist Gives Navy Patrol Plane Extra Kick in the Clinches

IF THE Navy's Neptune patrol plane has to get out of a tight combat spot in a hurry, its two piston engines now have the help of two jet units hung in pods under the wings. The twin jets produce 6,800 pounds of thrust, enough power to fly the Lockheed plane alone. The jets also help in take-offs from short runways.

Turboprops Add Speed, Range

WITH four turboprop engines, the newest of the Air Force's Globemaster series of transports, the Douglas YC-124B, can fly faster, farther and higher than ever. The 5,500-horsepower engines enable the huge 100-ton plane to carry 200 soldiers.

Lightplane Has Wing-Tip Tanks

FUEL is carried in teardrop wing-tip tanks in this new five-place Cessna 310 private plane. Among the advantages claimed for the arrangement is that, with the gasoline away from the cabin, it is less of a fire hazard for the passengers.

Rotor Blades Lift, Prop Speeds First Military Convertiplane

CONVERTIPLANE means an aircraft that takes off and lands vertically like a helicopter, then, on reaching altitude, converts in flight to a more efficient form of propulsion for faster forward flight—in this case a rear-mounted propeller, with stub wings to provide lift.

The McDonnell XV-1 has a piston engine mounted at the rear of the fuselage. For helicopter take-off and descent, the engine supplies air to pressure-jet units at the tips of the rotor blades; during forward flight it powers the propeller.

Developed for the Air Force, the experimental XV-1 is expected to make its first flight this summer.

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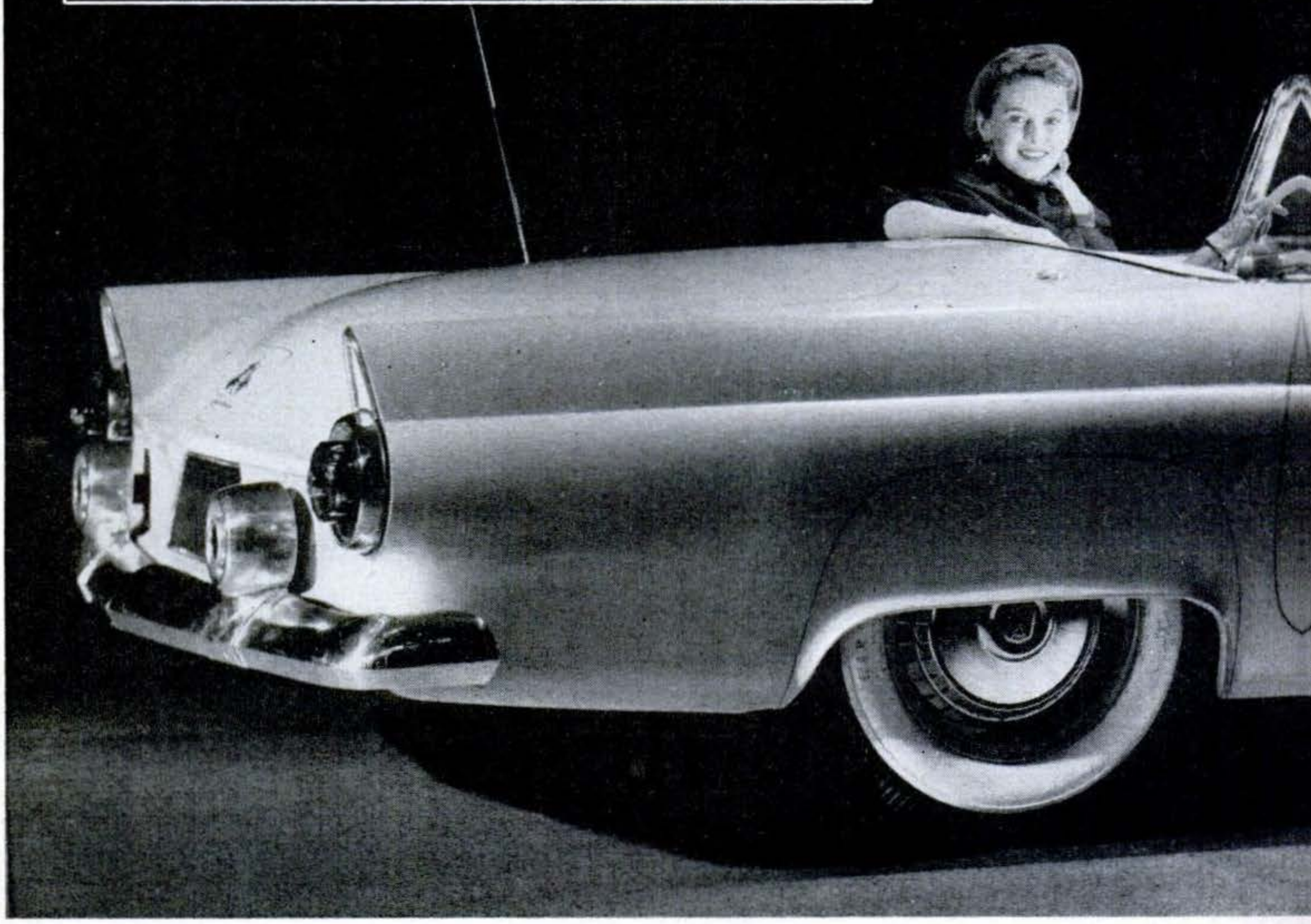
Steel body under a removable plastic hardtop is used on the Thunderbird. Car is very low; top of door is only 33.7 inches from ground, though road clearance is 5.5 inches, only slightly less than that of other Fords. Steering column has telescopic adjustment with 3-in. range.

Beneath that hood is a 160-hp. OHV V-8 power plant. Engine has displacement of 256 cu. in., same size as the current Mercury. But Ford engineers assert solemnly that it is not a Mercury mill. Those rear bumper-guard spinners in photo below terminate the twin tailpipes.



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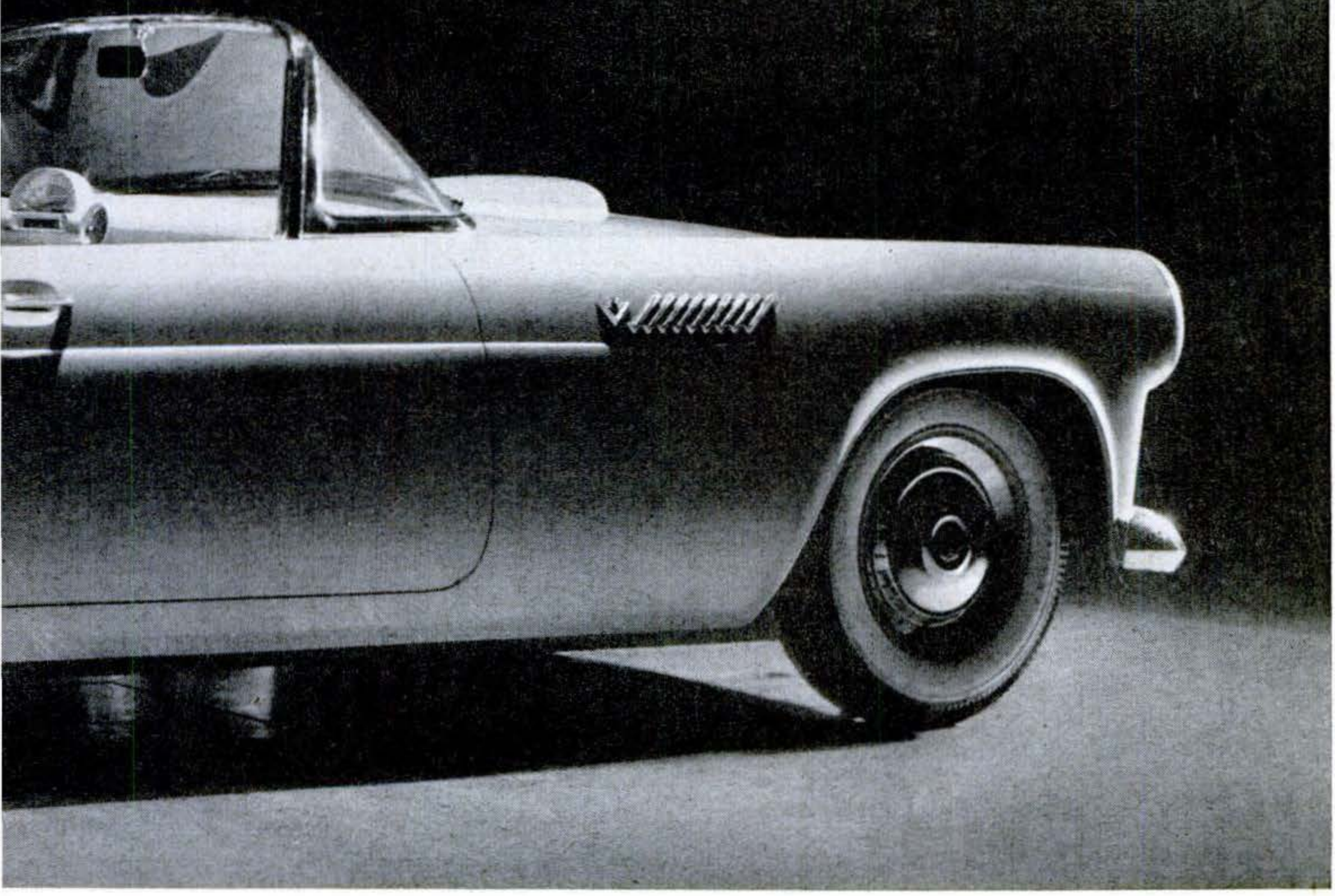
Swanky New Ford Is Sweet and Low

This 160-hp. sports car is intended to be fun to drive. No dream job, it will be built for sale.

VISITORS to Ford's Dearborn test track have been seeing small blurs streaking around the high-speed oval. Watching one of them flash into the straight will remind even the tamest sedan pilot that on some cars the gas pedal can accurately be called the "exhilarator."

The blurs have been test versions of the Ford Thunderbird, a 2,833-pound, 160-horsepower sports car. Not just a designer's dream for auto-show custom-



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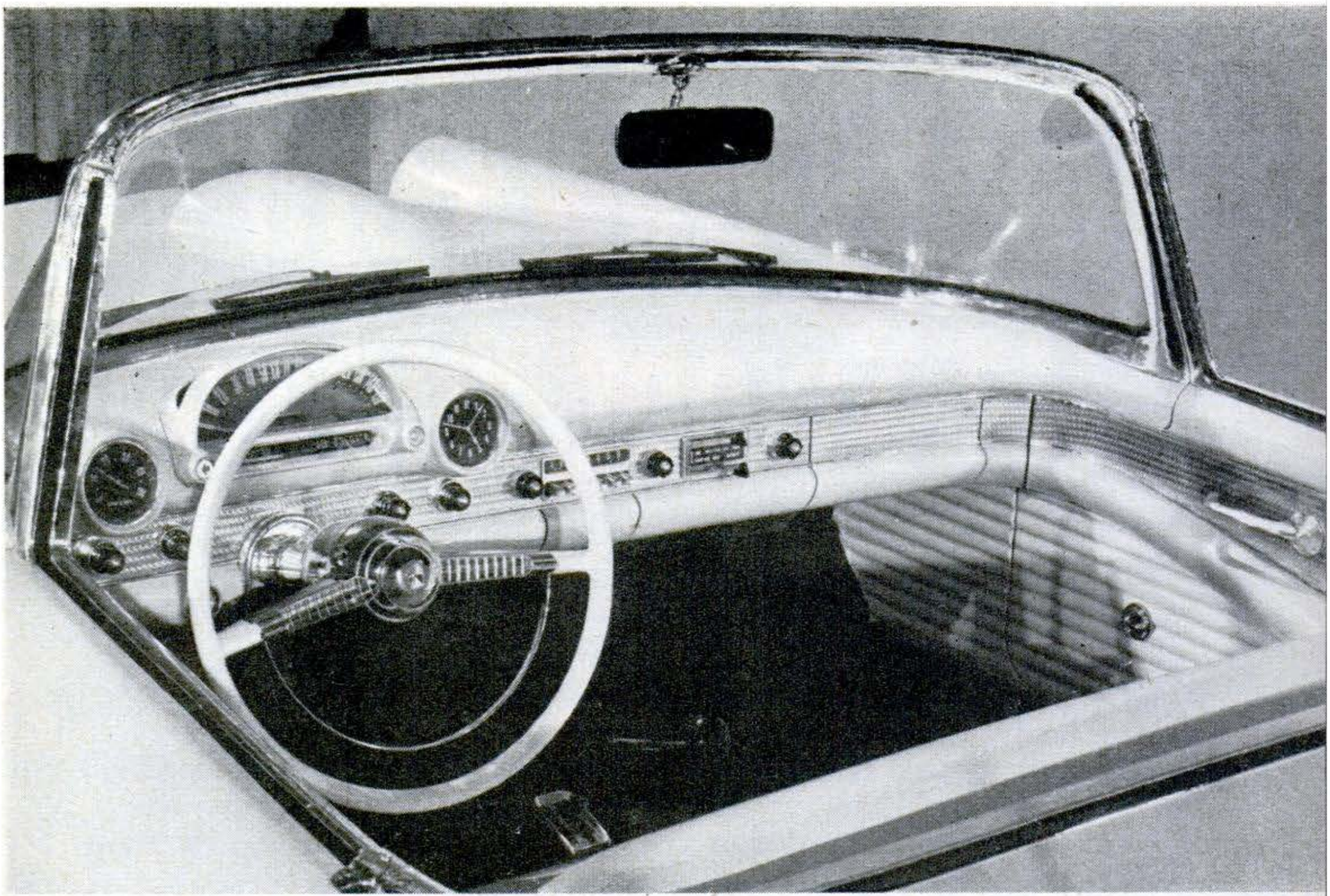

THAT'S A TACH at the left of the panel. The stick shift on the floor works a manual three-speed box. If you insist, you can have a Fordomatic drive, with a floor range selector.

ers to goggle at, Thunderbird is a roadable car that will be produced in sizable quantity this fall. Ford executives are cagey on price, but Detroit rumors set it just above $3,000—a few hundred below the tag on the Chevrolet Corvette.

The Thunderbird, in development for several years, puts Ford squarely in the prestige trade of building high-performance but medium-priced "personal" cars. Long dominated by imports, the field has lately had such lively entries as the Kaiser-Darrin and the Corvette. All three are short-wheelbase jobs—102 inches for the Thunderbird and Corvette, 104 for the K-D. Each is extremely low, and each is a two-seater. Pounds per horsepower, the "jump" index, figure out at 17.7 for the Thunderbird, 19 for the Corvette, and 23.8 for K-D. Ford engineers say that if you stage a drag race between Thunderbird and a stock OHV '54 Ford V-8—no slouch—the new car will pile up a lead of 53 car lengths in 40 seconds.—*Frank Rowsome Jr.*

Ford's "Atmos" —or How Dreamy Can They Get?

THAT spooky craft at the right is the Ford "Atmos," a show car recently unveiled to bug the eyes of the public. Among its wonders are hand-grip steering, a "Roadarscope" in the dash to tell you what's ahead, and an automatic pilot. This last dingus takes over steering, responding to metal plates that may someday be installed in roads, "permitting the driver to play bridge between cities." Also envisioned are power-operated doors —no need to slam them by hand—and a microphone to allow a driver cocooned inside the sealed, air-conditioned egg to ask directions of people in the harsh world outside.

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REMOVABLE HARDTOP is warm and weather-tight, lifts off easily for storage in your garage. If rain catches you away from home, there's a regular cloth top in the deck.

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Wilbur Shaw Drives America's Newest Car

Economy-Size Nash Is Fast and Fancy

By Wilbur Shaw
President, Indianapolis Motor Speedway

BEEN looking for a way to save gas—lots of it?

Been looking for a snug little car that you could jig through traffic with a toe and a finger and ease down the turnpike at 65 m.p.h.?

Been itching for the flair of a European automobile without giving up good old American comfort and flexibility?

If you're nodding "yes" to all these questions, the car for you may be a new 42-horsepower fireball called the Nash Metropolitan. I found this economy-size package as solid as a little tank and scatty as a racer.

Beside the Metropolitan, even Nash's

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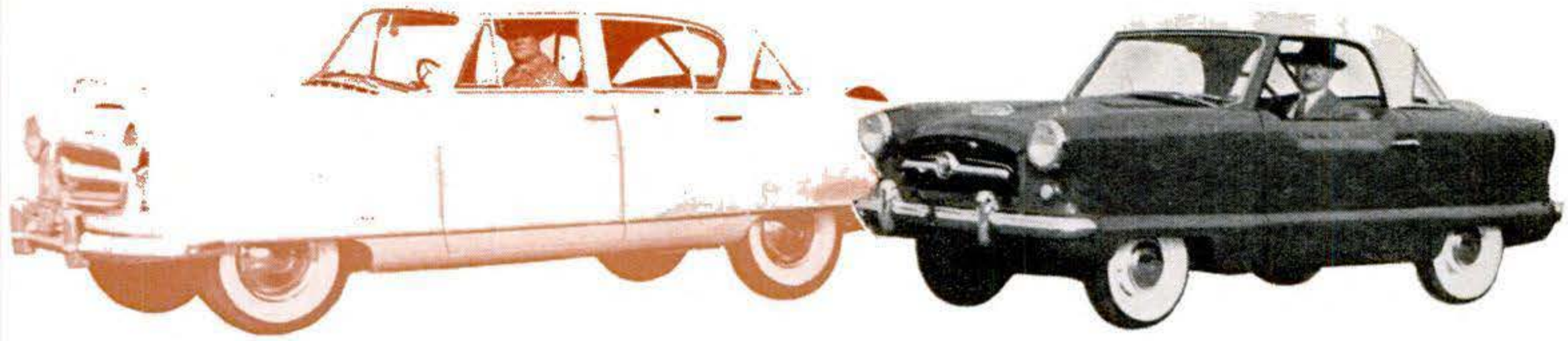

Rambler's baby brother can run like 60, or even better, consumes gasoline sparingly, and cuts a pretty figure.

A THOROUGHBRED from any standpoint, this new member of the under-one-ton class of cars is nevertheless a hybrid. Designed by Nash in the U.S., it is being built in England by Austin and Fisher-Ludlow.

junior-league Rambler looks big, as you can see at the top of this page. The Rambler is, in fact, as much as 865 pounds heavier and 3½ feet longer, depending on which models you compare.

The Metropolitan, which weighs less than a ton and is just short of 12½ feet long, demands attention from the moment you shut its doors. That good, solid *chunk* of metal on metal says sound body construction. Close your eyes, and this could be the biggest car on the road.

Packs Punch on the Starting Line

The body styling shows Pinin Farina's fine Italian influence, although it was done by Nash designers. A surprising feature is the high roof line, only half an inch lower than that of most big cars.

The Metropolitan comes in two models—a hardtop and a convertible. I drove the former, a dark-green-and-gray beauty. It started almost soundlessly, punched my two passengers and me back in our seats when I gave it gas, and turned on its tail when I spun the wheel. It has many sports-car character-

INSTRUMENTS are standard, though there is no water-temperature gauge. Heating-ventilating system is scaled-down standard Nash equipment. Radio, turn signals, lighter and wipers are factory-installed.

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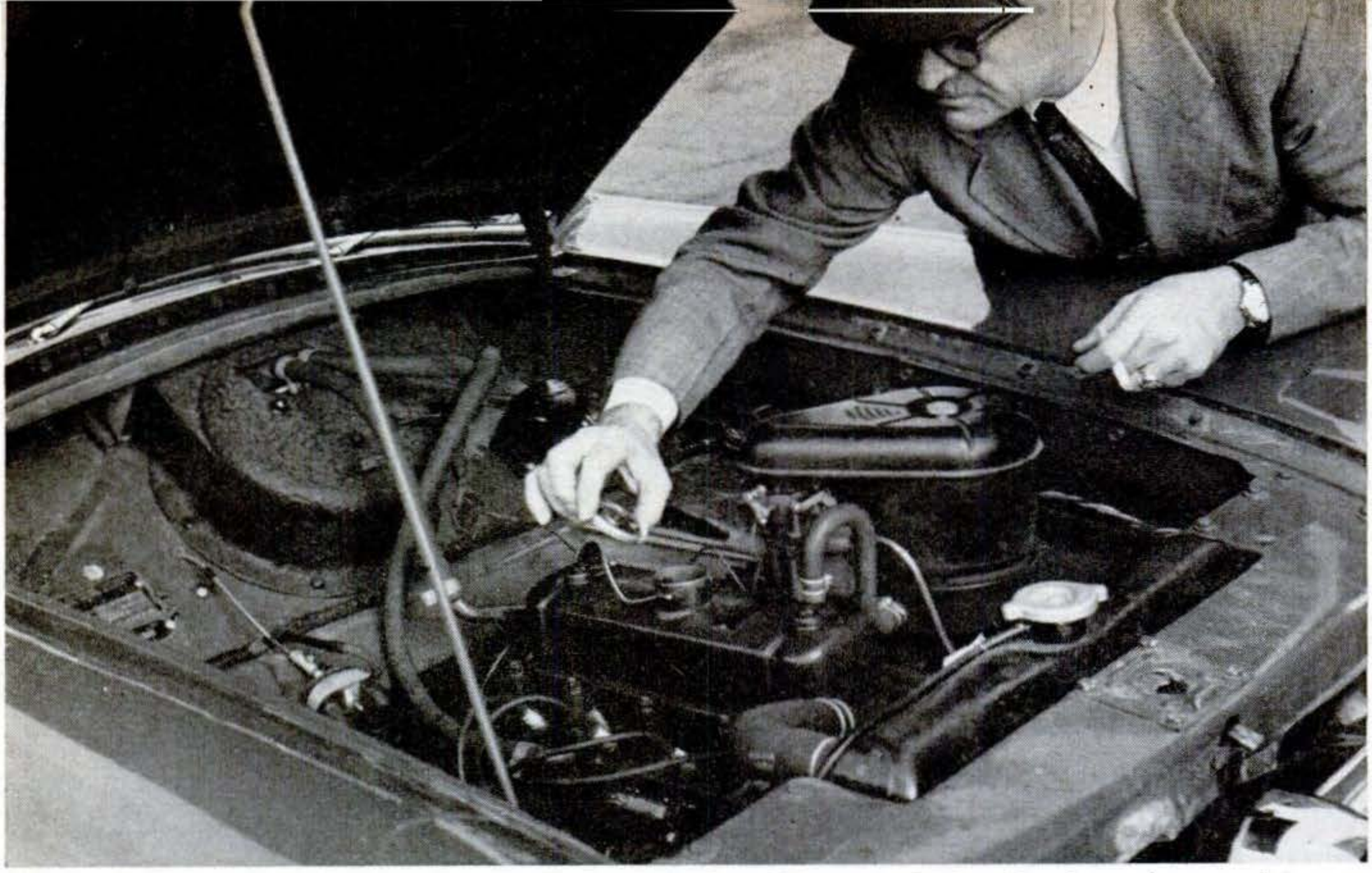
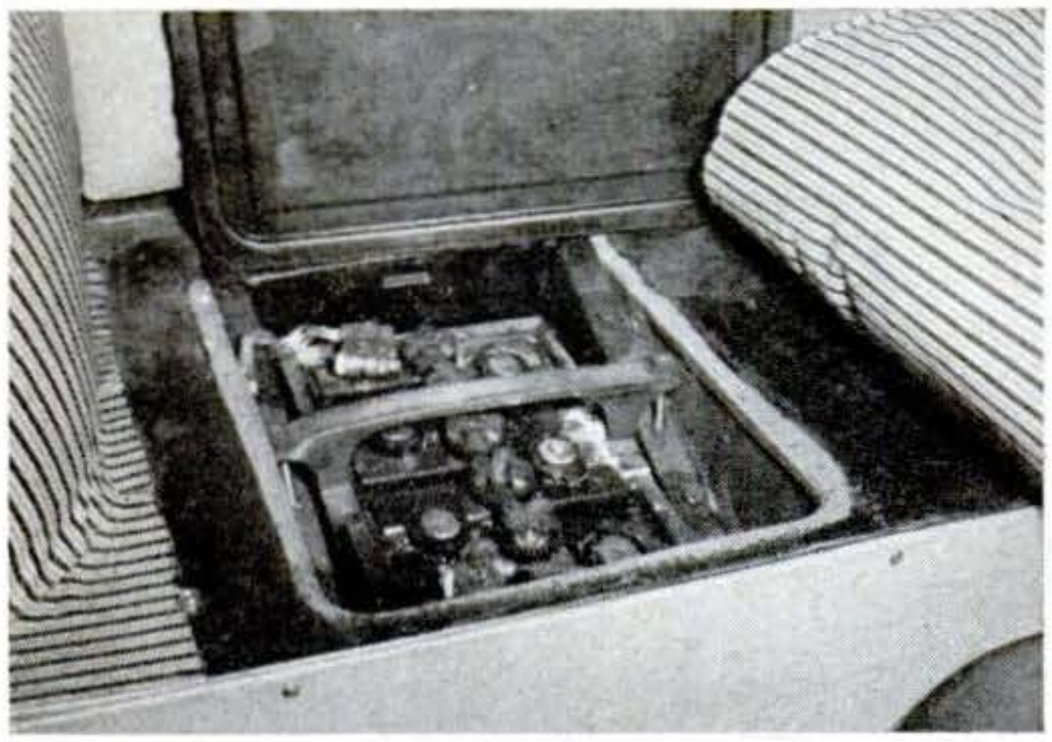


Chained-down oil-filler cap that can't be misplaced is typical of refined touches on this car.



UNDER THE PADDED BACK SEAT and beneath an access plate lies a 12-volt battery. This has long been standard equipment supplied in cars that are manufactured in England, but I was somewhat surprised to find one installed in a small American automobile—and a four-cylinder job, at that.

istics. You get that cockpit feel because of the car's modest size, but, in addition, steering is tight and responsive, and there is a sensitive sureness when you run through the gears. Like the Rambler, the Metropolitan is shifted by a post lever working through a ball-and-socket on the dash.

There seems to be jazz aplenty in this little car. It did 75 m.p.h. in the test runs of the National Association of Stock Car Racing on the Raleigh, N.C., Speedway last winter. Nash engineers told me that they have found that it tops 70 m.p.h. easily.

I didn't attempt anything like that on Chicago's streets, which is primarily

FACTS ON '54 NASH METROPOLITAN

Model: Hardtop coupe.

Engine: 4-cyl. OHV; 42 hp. at 4,500 r.p.m.; compression ratio, 7.2:1; piston displacement, 73.17 cu. in.; bore and stroke 2 37/64" by 3½"; torque, 62 lb.-ft. at 2,400 r.p.m.

Weight: 1,825 lb.; per hp., 43.5 lb.

Transmission: 3-speed manual synchromesh; rear-axle ratio, 4.625:1.

Steering ratio: 21:1.

Springs: front, coil; rear, semi-elliptic.

Outside dimensions: height, 54½"; overall length with bumpers and guards, 149½"; width, 61½"; wheelbase, 85"; overhang, front 28⅝", rear 36⅛"; tread, front 45 5/16", rear 44 13/16".

Inside dimensions: seat-cushion width, 49¾"; leg room, front 49¾"; headroom, 35½"; seat height, 10"; vertical distance, steering wheel to seat cushion, with the seat in mid-position, 6¾"; front-seat adjustment, horizontal, 4".

Tire size: 5.20 by 13.

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where I tried out the Metropolitan, but I did 60 on a deserted roadway. And there was still plenty of room between my right foot and the floor.

The car gives astoundingly good gasoline mileage, too, though it may not be as good as the 41 miles to a gallon chalked up in the Raleigh tests. That is an "open-highway" figure. But even city driving will be plenty economical.

Extra Seat Takes Adult or Children

Remember that I said three of us were in the car I tested. Behind the two standard, upholstered front seats is a padded bench seat. It is big enough for an adult on short trips and ample for one or two children on longer runs.

We rolled over plenty of rough spots on the workout I gave the Metropolitan, but the little car did well. Nash's independent front coils smooth things out nicely on all their cars, but in this one they've remounted the springs between wheels and body. Each spring is out nearer the wheel, lodged between the upper control arm and the body structure. This makes for faster-triggered and more positive spring action. Combined with the smoothness of the car's Hotchkiss drive, it makes for an unexpectedly easy ride.

I didn't notice any low spots in performance, but this is one of the cars you have to shift and drive if you want to avoid mushy behavior.

A modified version of an English four-cylinder, overhead-valve engine, the Austin A-40, runs the Metropolitan. The Nash modification has four piston rings instead of three, and the latest British (not American) Zenith downdraft carburetor. Compression ratio is 7.2:1. Head and block are cast iron. The pistons are aluminum.

Both for protection and handy access, steering-linkage tie rods run above and behind the wheels through the engine compartment.

You get pleasant surprises tinkering with this car, too—like a hand pump on the mechanical fuel pump to suck up

[Continued on page 270]

FAMILIAR NASH FEATURE is the continental spare, which tips back for removal. The luggage compartment doesn't open from outside.

TURN A TUMBLER LOCK in the back of the rear seat and the panel folds down, opening up a roomy compartment for suitcases.

JACKING IS AN EASY JOB, done with a unique, triangular screw jack that fits into a special bracket midway on either side of the car.

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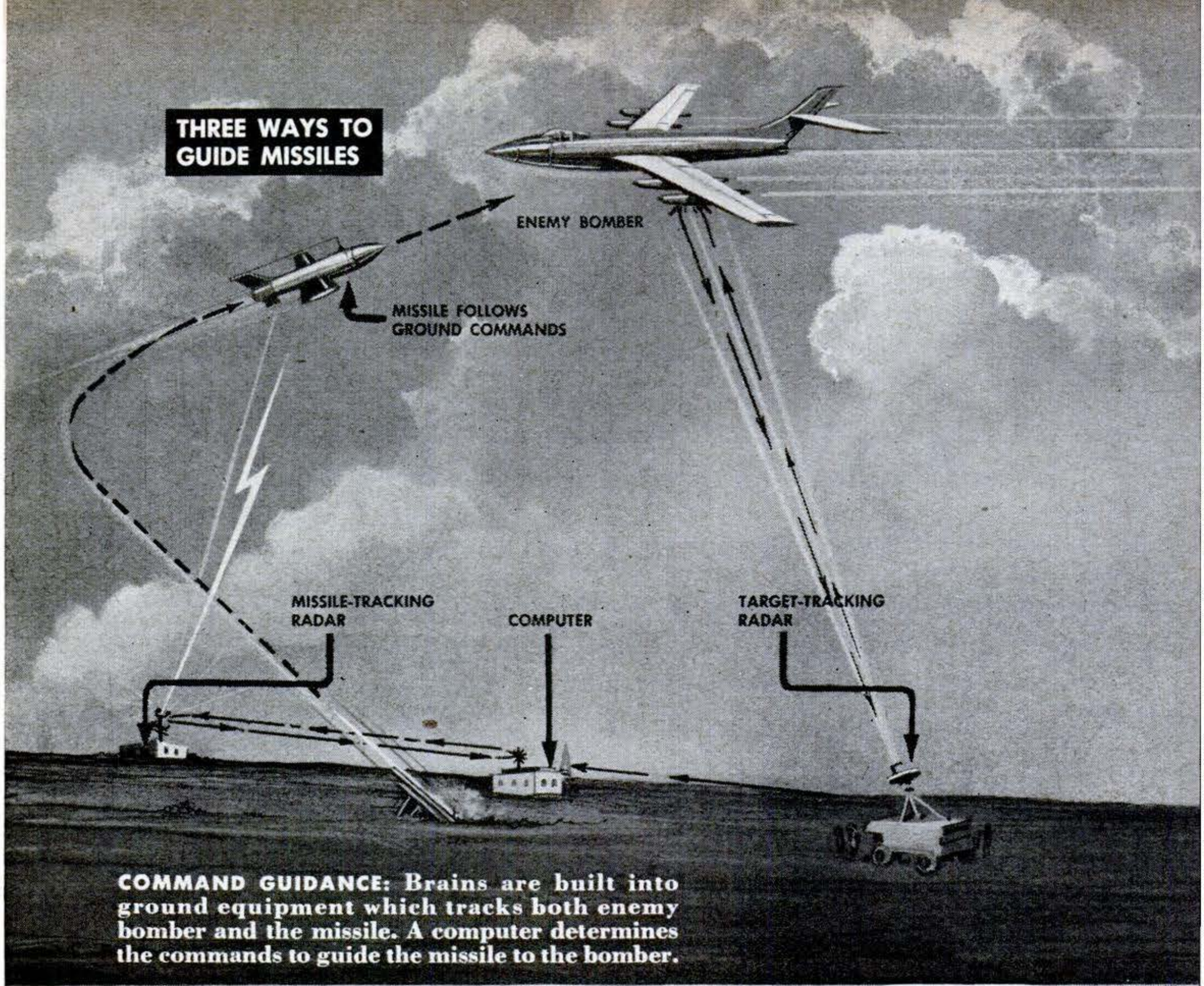
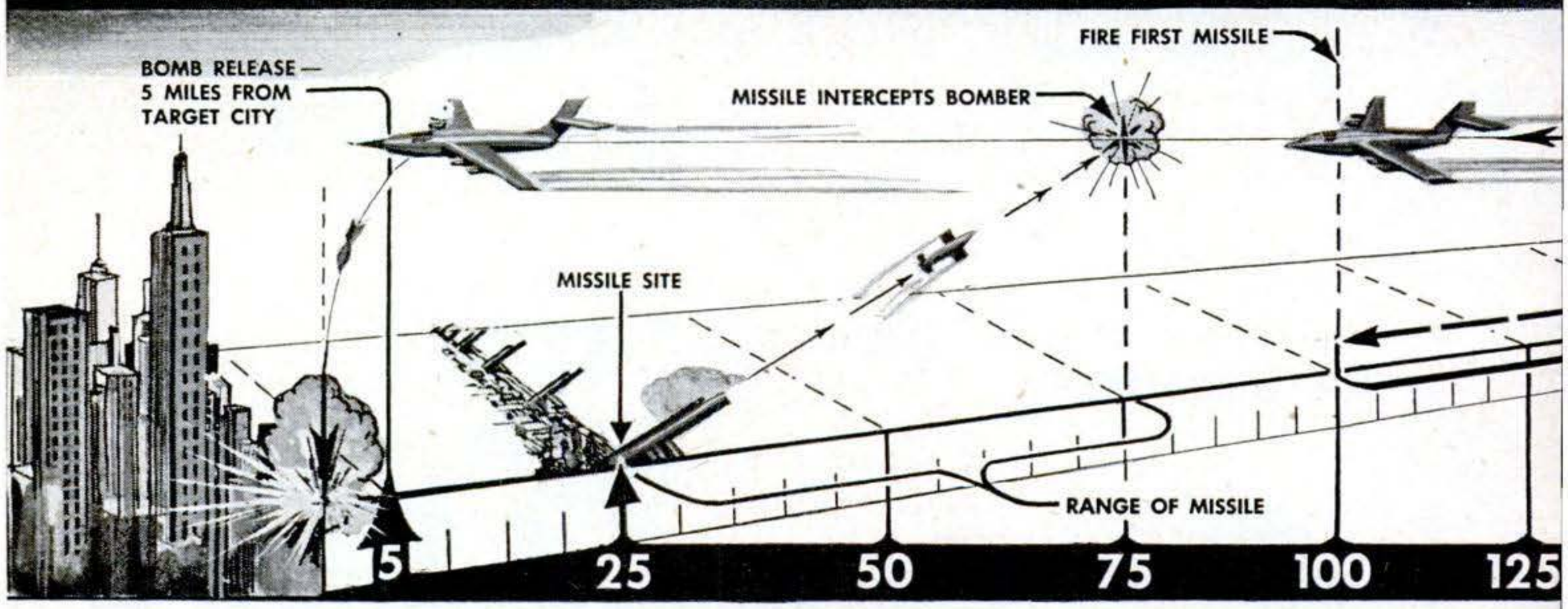


COMMAND GUIDANCE: Brains are built into ground equipment which tracks both enemy bomber and the missile. A computer determines the commands to guide the missile to the bomber.



How Missiles Would Defend Our Cities

SUPPOSE you were to defend a city against 600-mile-an-hour bombers with 1,200-mile-an-hour guided missiles. It's complex, as shown in the drawing above, based on a lecture by Henry H. Porter of Johns Hopkins. Since the missiles, launched from a site 25 miles outside city, have a 50-mile range, the first one should intercept the attacker at a point 75 miles out. But since the bomber will have flown 25

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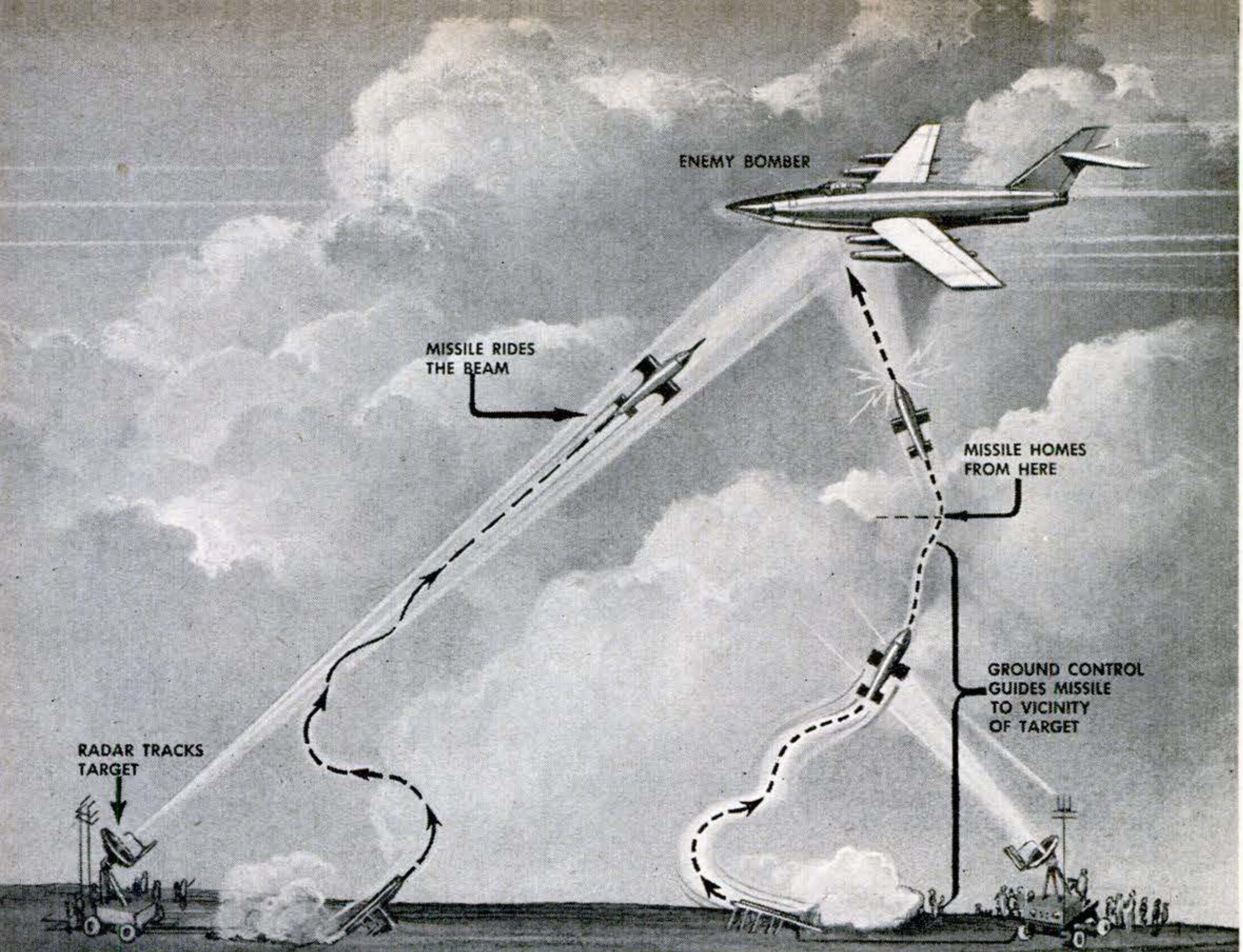
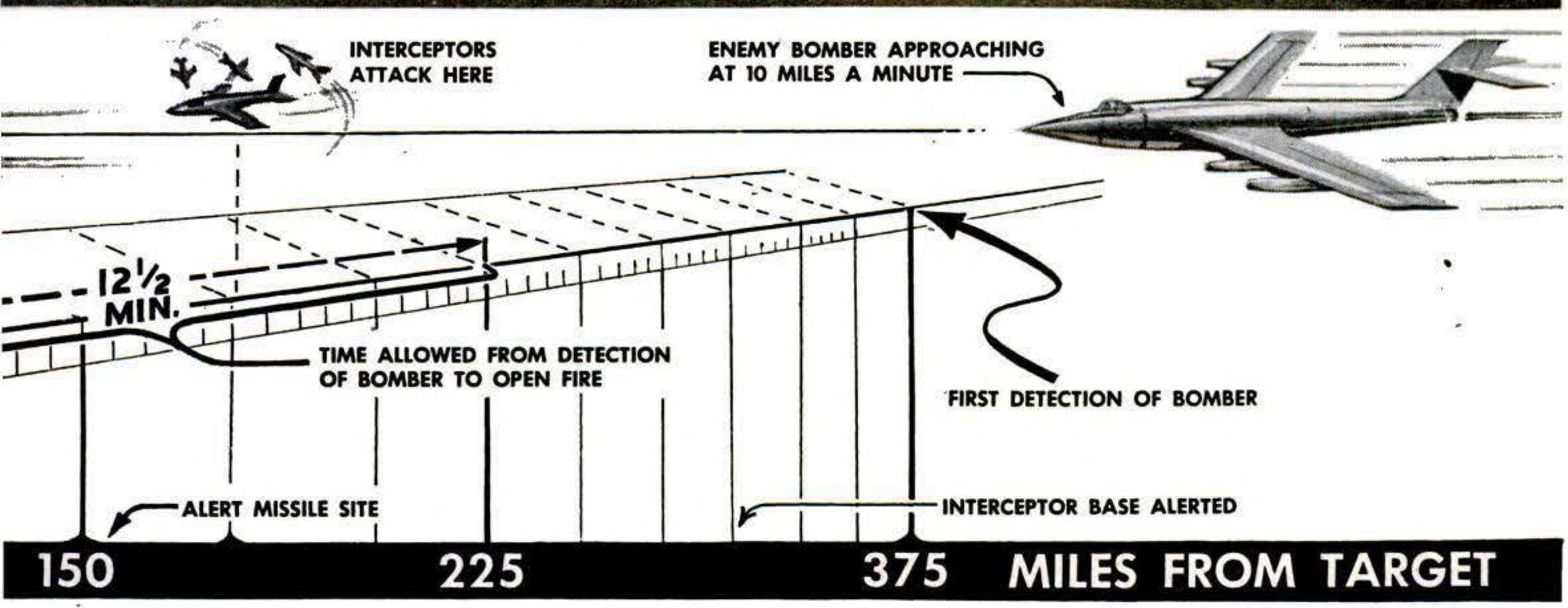


BEAM RIDER: Brains are divided between ground equipment and the missile. Ground radar tracks the bomber, and the missile gets on the radar beam and rides it.

HOMING GUIDANCE: Brains are built into the target-seeking missile. Ground equipment guides the missile to the general vicinity of the bomber. From there the missile homes on its own.



miles while the missile has sped 50, the missile must be fired while the attacking plane is 100 miles from the target city.

The missile site needs five minutes to get ready, however, so it should be alerted when the bomber, coming at 10 miles a minute, is 150 miles out. But before that can be done, an additional 7½ minutes must be allowed for identification and tracking of the enemy bomber—which means that it should be detected when it is 225 miles away.

Now, if we want to get some of our jet interceptors upstairs, they should attack beyond missile range. Allowing 10 minutes for this air battle, the interceptors would engage the enemy 175 miles out. But jets need 20 minutes to get into the air, and for early warning. Thus, the attacking bomber must be detected a minimum of 375 miles from the city. END

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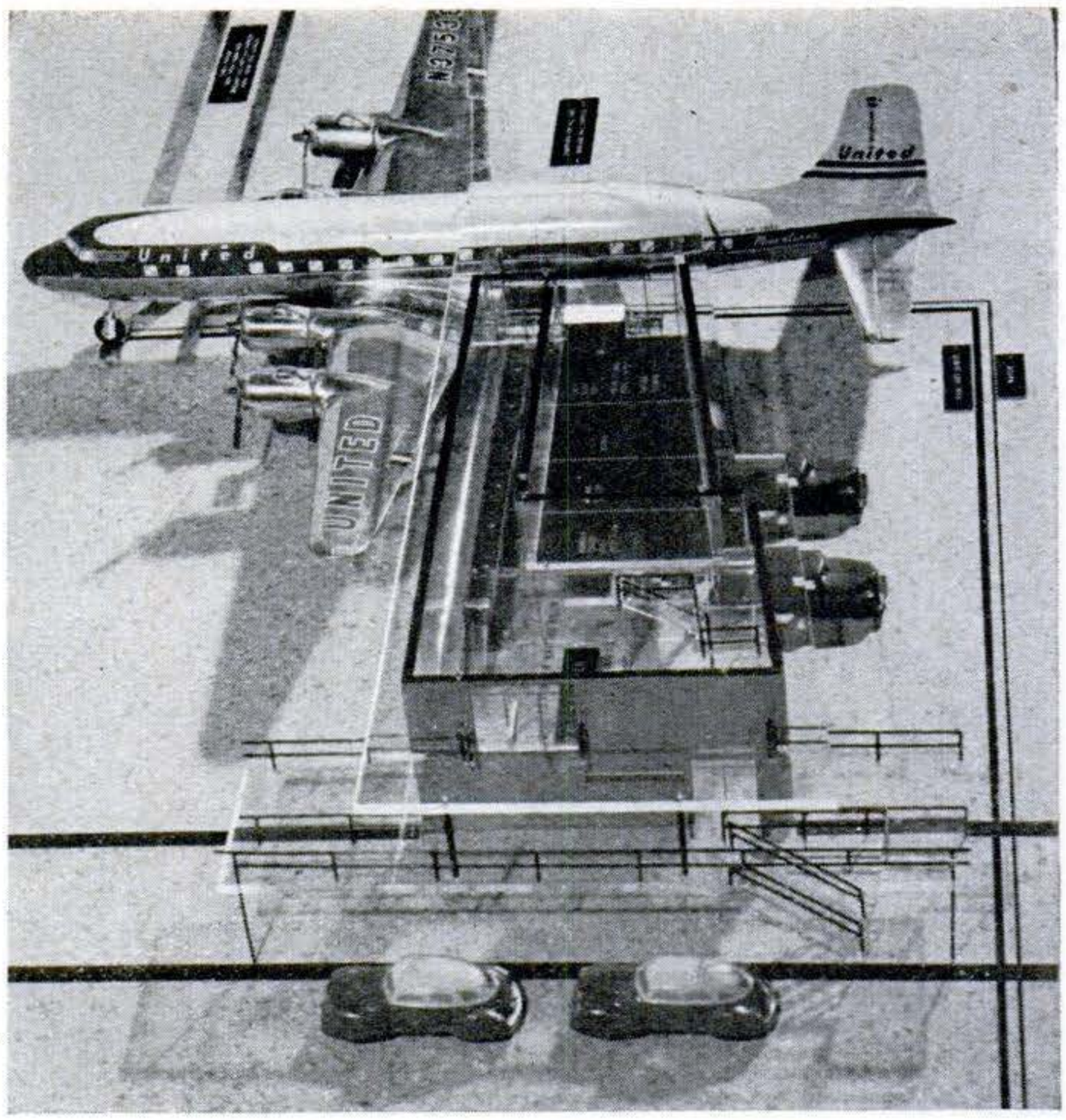
Novel Airdock to Unsnarl Traffic

A TWO-STORY airdock for loading and unloading airplane passengers, baggage and cargo with a maximum of speed and efficiency has been built at Denver by United Air Lines. A plastic "see-through" model of it is shown at the right.

The airdock abuts each arriving or departing plane, moved into place by a special rig. Mail, cargo and luggage are received on the ground floor and moved from there into the plane on conveyor belts. This routine is reversed for incoming flights.

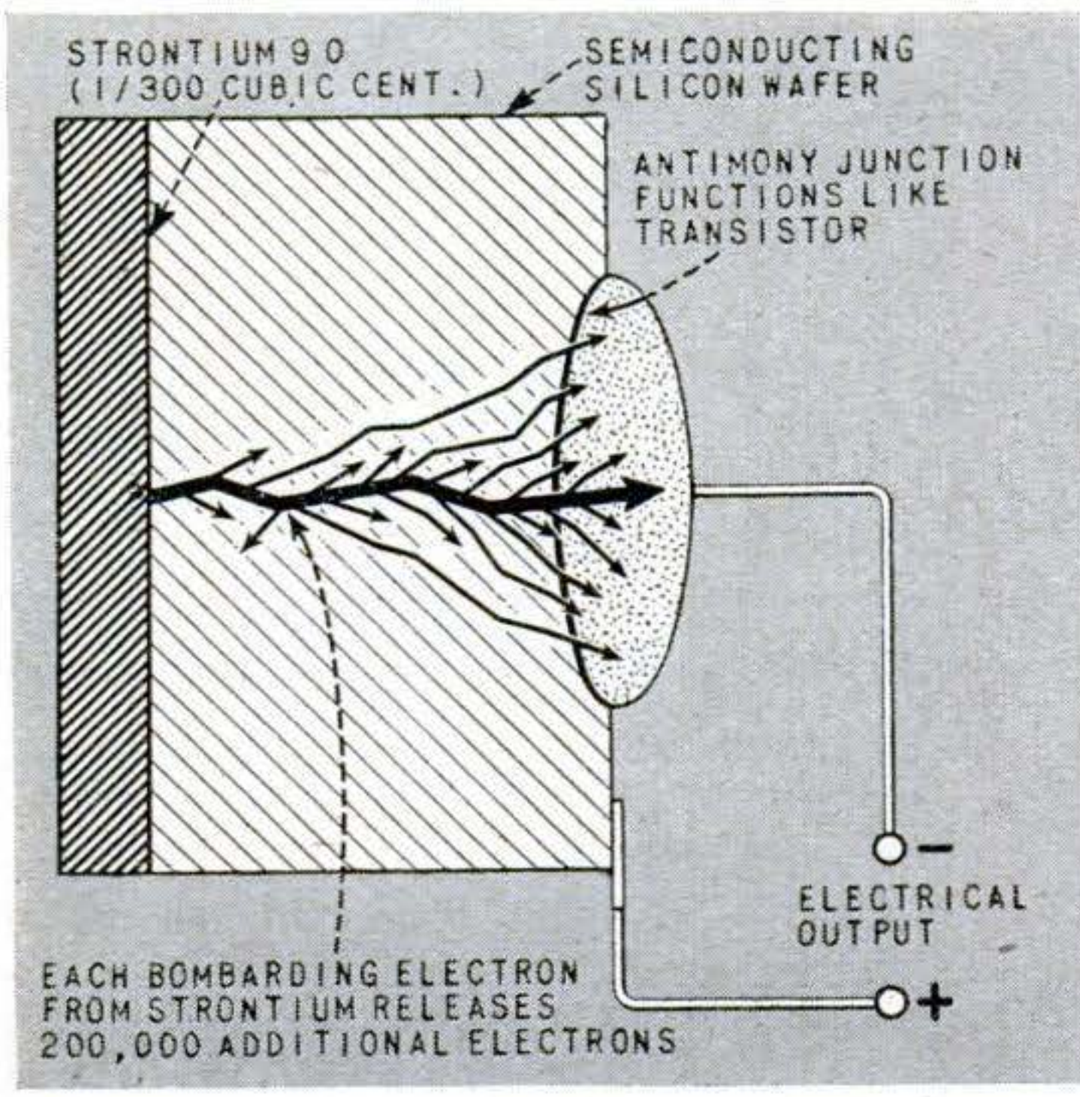
Passengers step straight into planes from the airdock's second floor, without being exposed to the elements.



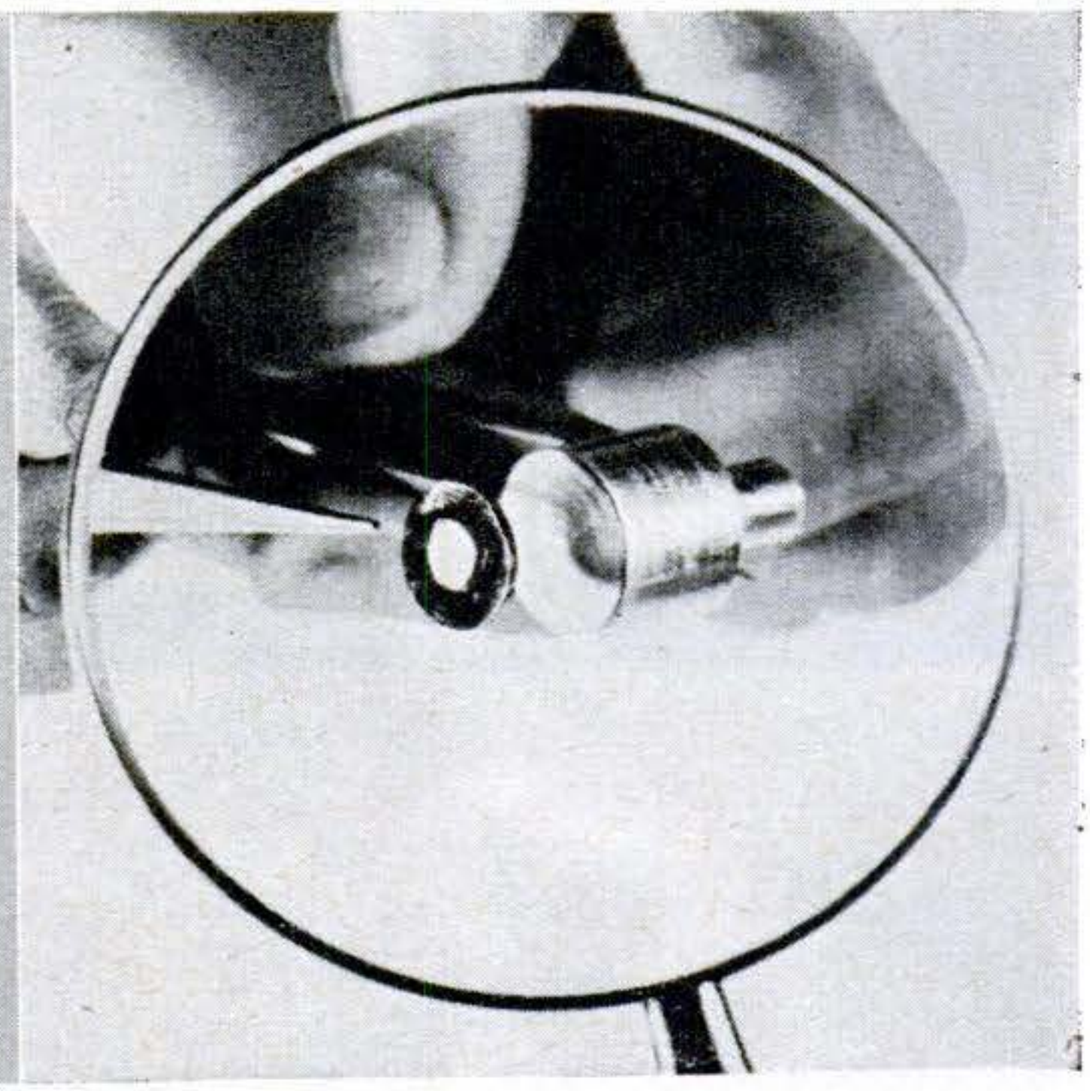
Bean-Size Battery Converts Atomic Energy to Electricity

TINY herald of a future day when your radio, lamps and even your refrigerator may have built-in power is an atomic battery that was recently announced. Developed by RCA, the experimental battery produces only a millionth of a watt of current, but its promise lies in the fact that it directly converts nuclear energy into electricity in a more efficient way than any discovered before. It multiplies by 200,000 the energy from a practically invisible amount of radioactive strontium.

Earliest practical uses are expected to be in hearing aids and pocket radios.



HOW THE ATOMIC BATTERY WORKS is shown simply in this drawing. Electrons released in the wafer of semiconducting material build up voltage as they flow across the junction.



BASIC ELEMENTS of the battery are best seen under a magnifying glass. The cylinder at right above has a thin radioactive coat. At left is silicon wafer with dot of antimony.

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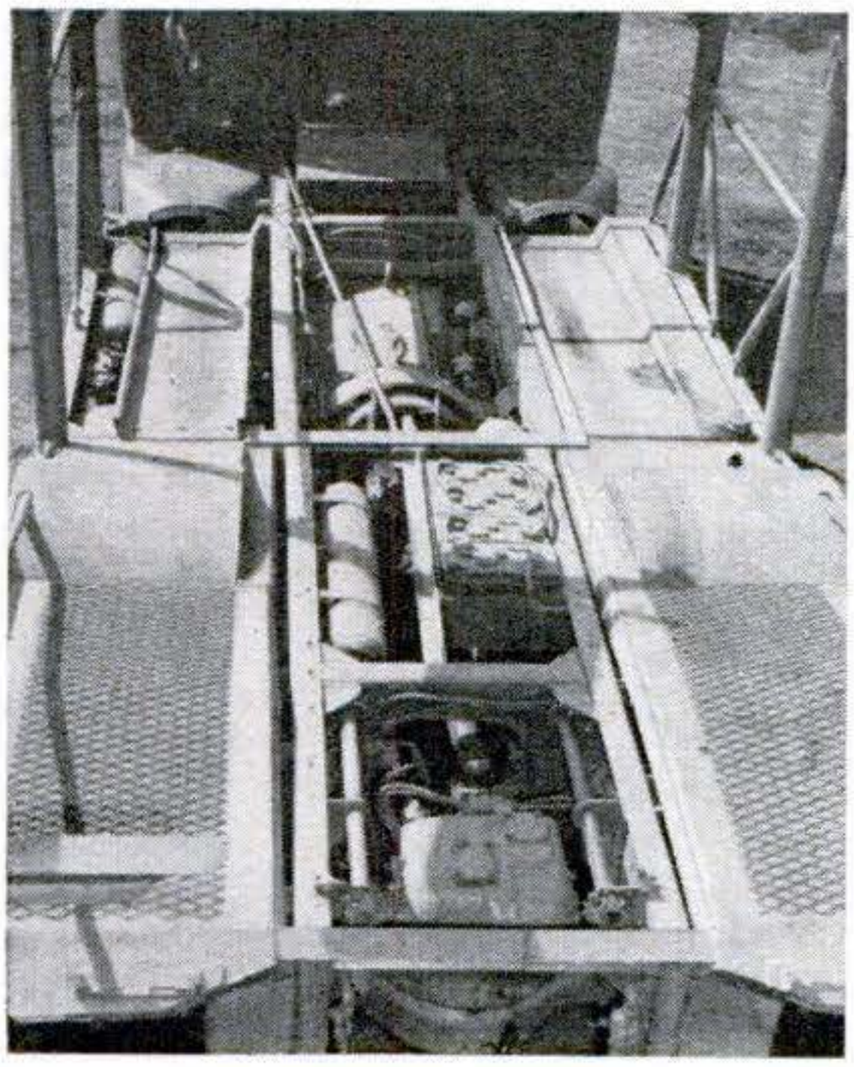
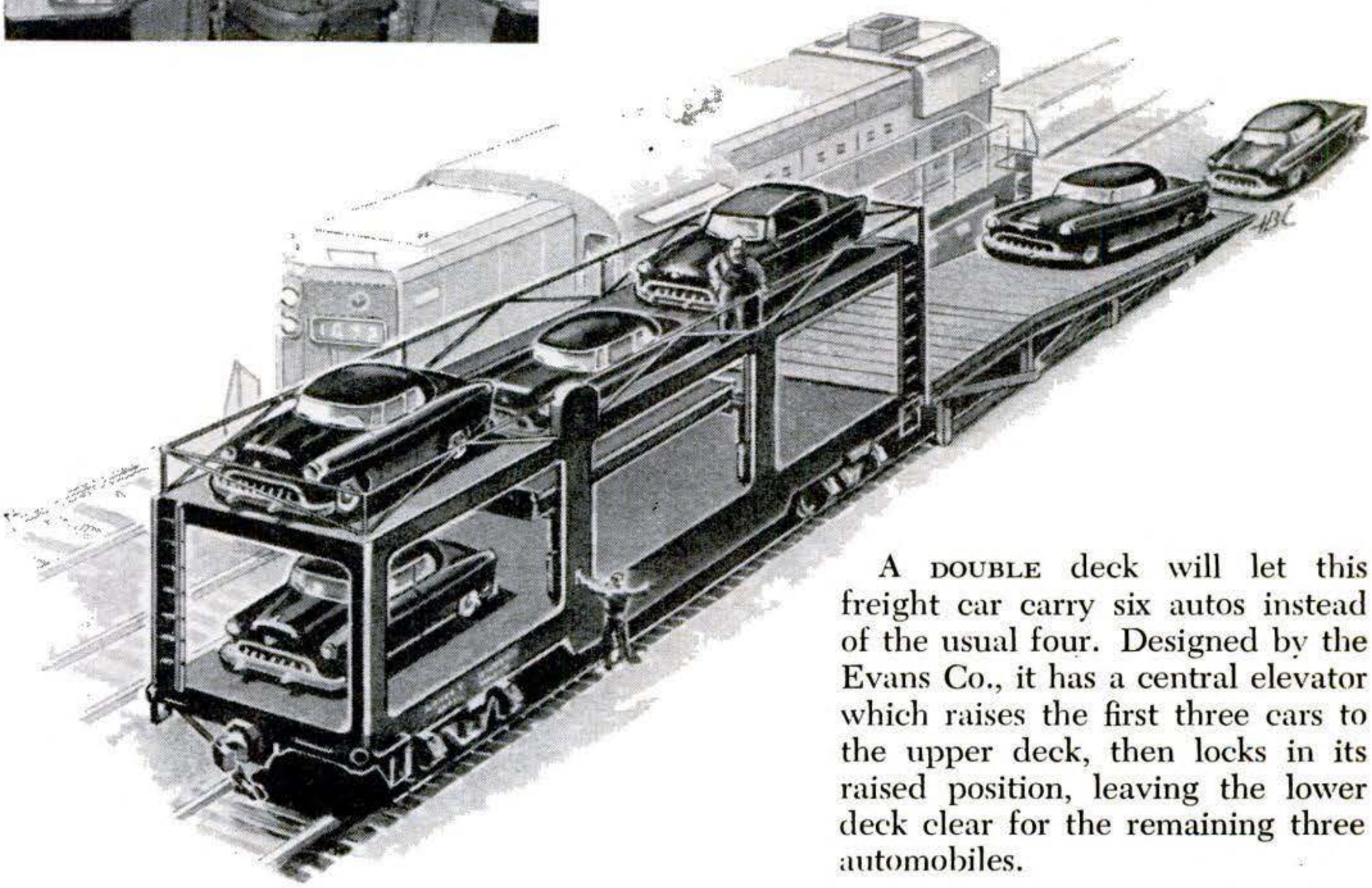


Seven Cars Hitch Ride on Highway

SEVEN cars ride piggyback on this diesel-powered carrier. Its Cummins pancake engine is inset in the truck bed, as shown at left, with two radiators angled behind the front wheels to cool it. The rig makes 3½ round trips a week between a California assembly plant and dealers in the Portland, Ore., area. Two drivers, alternating at the steering wheel and a sleeping berth in the cab, push the truck and trailer a distance of 19,800 miles a month at a maximum speed of 45 miles an hour.

The Convoy Co., Portland, built the automobile carrier in their own shops.

Six Cars Ride Upper and Lower Berths on Rails



A DOUBLE deck will let this freight car carry six autos instead of the usual four. Designed by the Evans Co., it has a central elevator which raises the first three cars to the upper deck, then locks in its raised position, leaving the lower deck clear for the remaining three automobiles.

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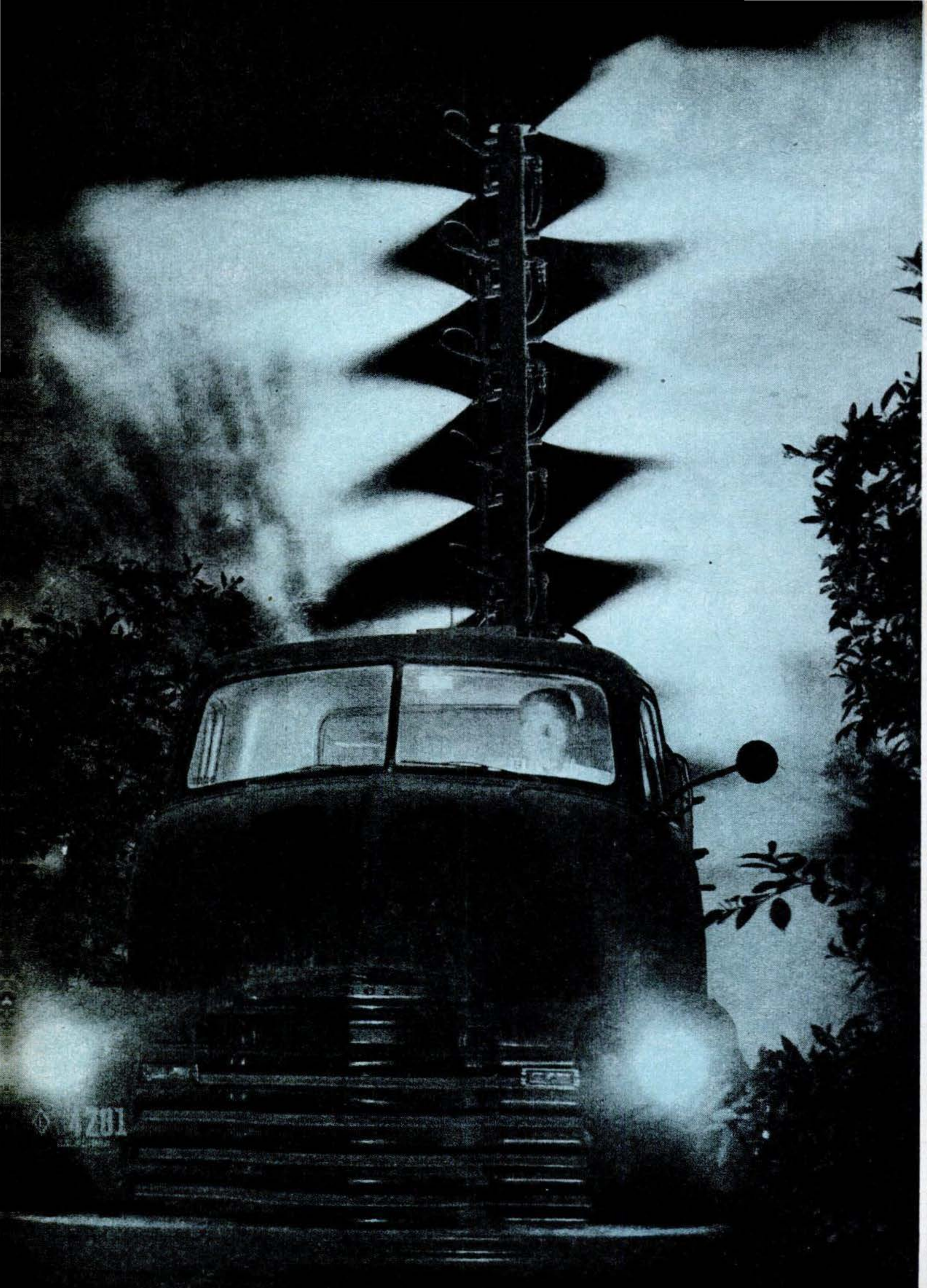

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A GRIM TOUCH OF HUMOR was that of painting figure 8s on the ball-like clusters of capillary tubes to be hung in trees being test-sprayed with vicious new insecticides. Amount of fluid that collects in the tubes shows how much spray is hitting bugs near 8-ball.

Nerve Gas Now Kills Bugs

Insect enemies are paralyzed as they feast on leaves that have absorbed poisons related to dreaded war weapon.

By Andrew R. Boone

FIRST cousins of the dread nerve gases that the Germans made in 100-ton lots during World War II but never used are now paralyzing and killing millions of our insect enemies.

Last year, one of the deadly new insecticides—the chief ones are named OMPA and Systox—routed the pests from more than 100,000 acres of cotton in Arizona and California. This year, the latest phase of the ancient war with bugs, which do around $4,000,000,000 worth of damage in the U. S. each year, is being greatly expanded. Planes are dusting crops with the lethal liquids, called systemics, in many parts of the West and South.

What makes OMPA and Systox such effective killers is that the plants on which they fall take the poisons right into their systems. Afterwards, for many weeks, any bug that feasts on the plants is a goner. The plants themselves are not hurt a bit.

A NIGHT GAS ATTACK, gaining by quiet air, strikes the insects in an orange grove.

The key to this insidious mode of attacking insects was found one crisp fall morning in 1951 by Dr. Lee R. Jeppson of the University of California at Riverside. From his cluttered office in the Citrus Experiment Station, Dr. Jeppson carried a small bottle of sticky

MASKED MEN, also wearing protective clothing lest the paralyzing bug killer harm them too, lay down a barrage in a California orchard.

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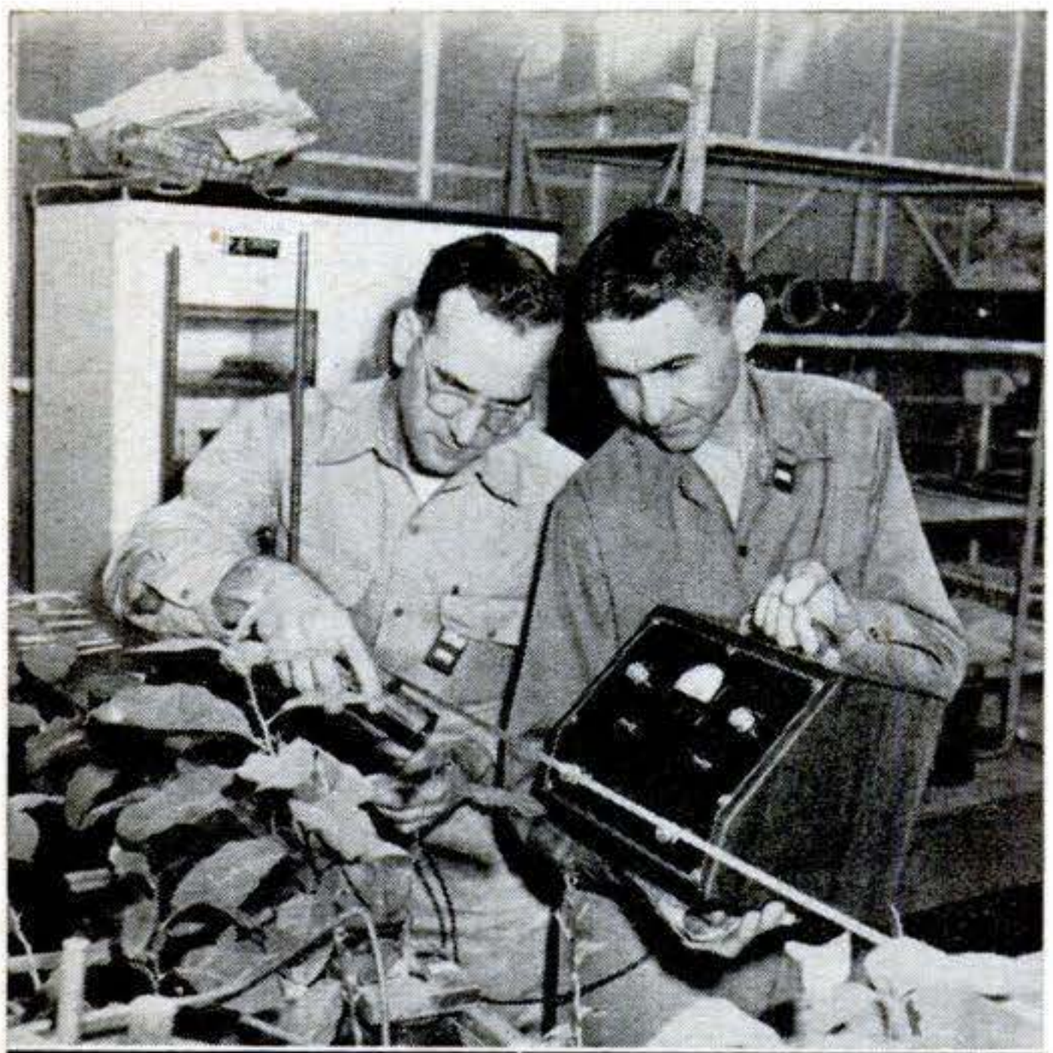

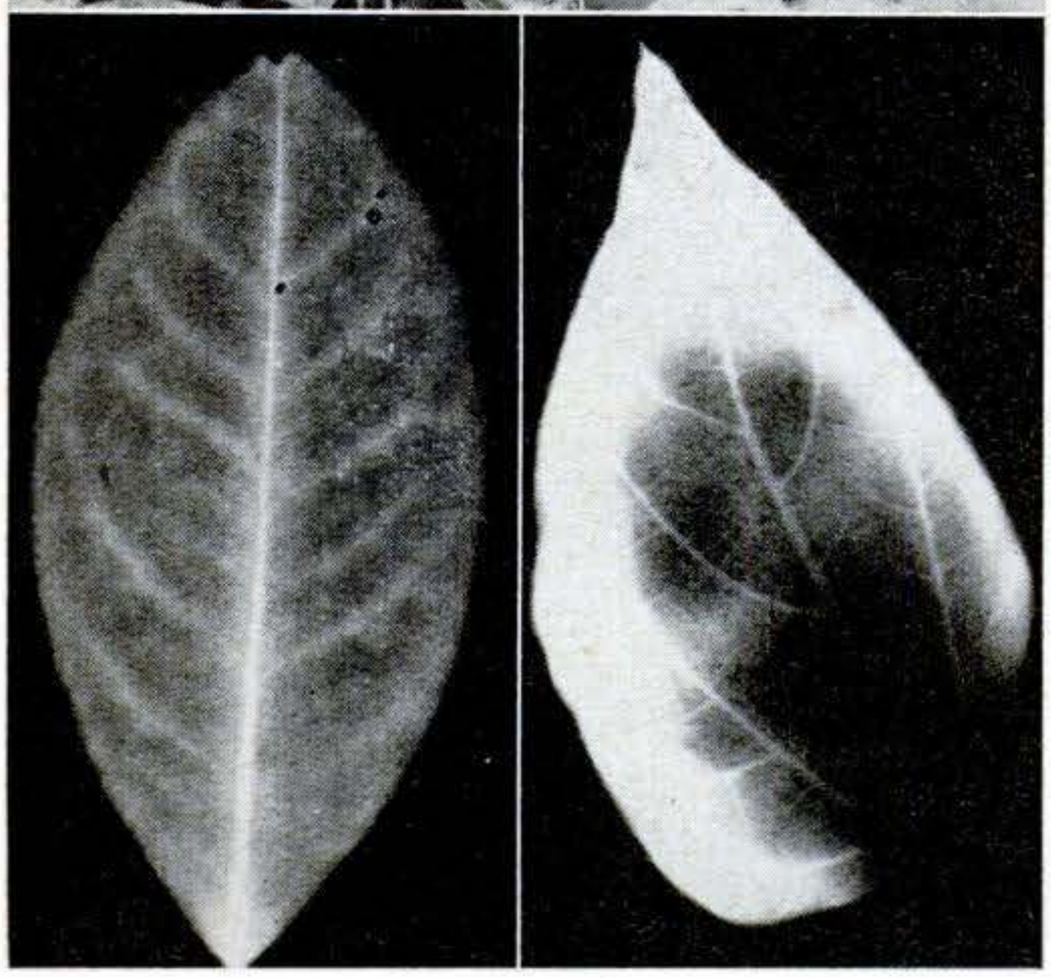

PROOF OF THE PERIL to bugs that feed on plants sprayed with nerve gas, the leaf photos above show, by means of a radioactive tracer, how thoroughly the poison spreads through a plant. At the top, scientists follow a tracer with their Geiger counter.

brown fluid and a paintbrush into the nearby lemon orchard. He selected a tree that was heavily infested with two kinds of mites and painted a band 18 inches wide around its trunk.

Six days later, Dr. Jeppson picked a hatful of lemons from that tree and brought them into his lab, where he turned them over and over in a hunt for insects. To his great surprise, there weren't any.

By his simple experiment, the scientist had made two important discoveries. He had proved that bark, contrary to common belief at the time, is absorbent, somewhat like human skin. The lemon tree had taken in a powerful insecticide through its bark, and the poison had traveled through the tree's sap stream to the leaves, blossoms and fruit. More, the poison had reached even the fruit in sufficient strength to kill sucking insects that fed on it.

These discoveries made possible a whole new strategy of insect warfare. They indicated that plants could imbibe poisons without harming themselves but with mortal danger to their foes.

Systemics Kill Underneath, Too

OMPA and Systox also solve another problem that previously perplexed crop growers and entomologists—how to get at bugs on the undersides of leaves. These amazing insecticides land largely on the upper surfaces, like other bug killers, but because they quickly enter the very life stream of the leaves, they soon doom insects nibbling at the bottom sides, too. Moreover, unlike most sprays, which kill for only a few weeks, the systemics pack a paralyzing punch for as long as four months.

Both man-destroying nerve gases and bug-destroying systemics come from a common organic phosphate ester, called diethyl fluorophosphate (DEFP). As long ago as 1936, German scientists found that this compound would kill animals.

From their original DEFP base, the German researchers branched in two directions. One route led to a group of phosphates (war gases), the other to a group of thiophosphates (insecticides).

The war gases and the insecticides kill by similar biochemical reactions. The former blind and choke humans, cause tremors and violent convulsions, stimulate nerve endings and leave water and mucus in the lungs. Death usually follows.

Insects do not have lungs, but the insecticides go for their nerve systems, paralyzing the life out of them.

Experts from the University of California followed up Dr. Jeppson's initial discoveries with many tests of ways to

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apply the systemics. Obviously they could not go around painting cotton plants and sugar beets, though for a highly localized infection a brush is as effective as a team of four men with a $5,000 spray rig. They sprayed crops with OMPA and Systox from planes and hand pumps. They pumped the insecticides under high pressure into trees, using oscillating nozzles to make sure that they reached the innermost leaves and fruit. They soaked seeds in the systemics before planting them. Field trials showed that the poisons reached their marks even when applied to the soil surrounding plants. The plants proceeded to absorb it through their roots.

Cotton was the first important guinea pig on which the systemics were tried in the U. S. Two years ago, four ounces per acre of Systox, mixed with water, virtually wiped out the mites and aphids in one large cotton field in the Imperial Valley. The patch remained free of insects for weeks.

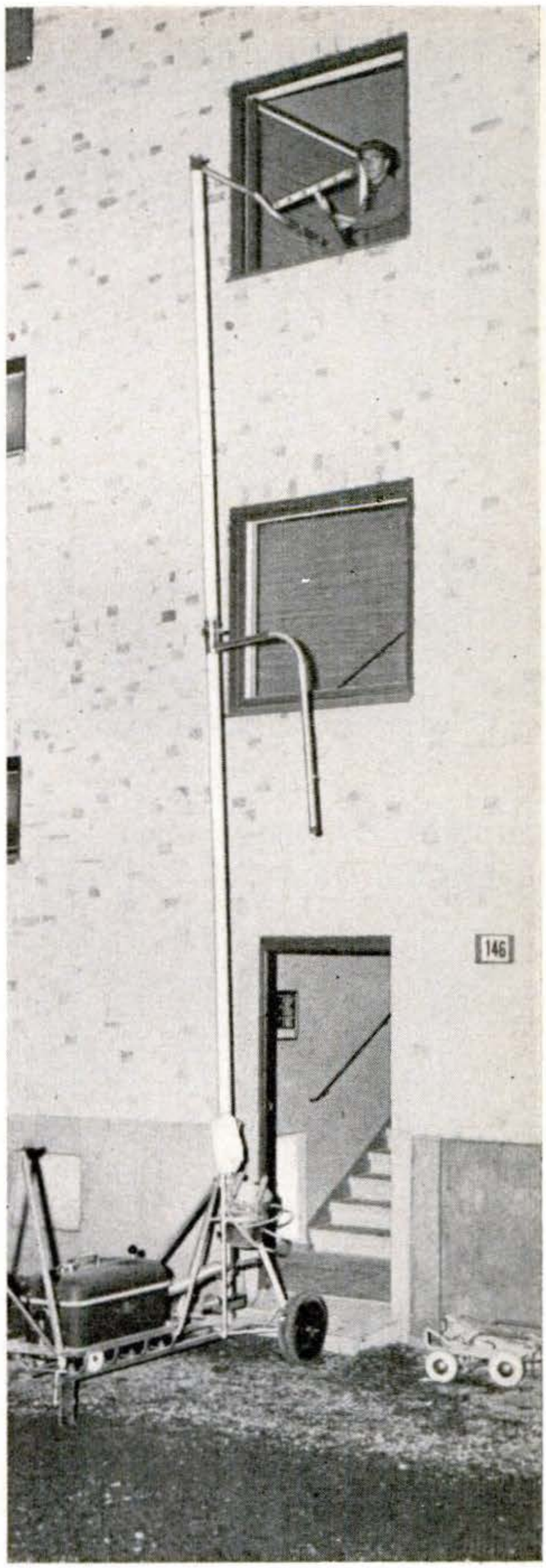
The UC entomologists are now trying other compounds, in an effort to knock out the pin bollworm and the boll weevil.

Although their main object is to protect California agriculture, the experimenters anticipate that their work will result in spreading a protective mantle over nearly all U. S. crops, including those from the rival groves of Florida.

Safe for Humans

You need not worry about being poisoned yourself. The systemics will not even make you burp. Not enough of them will remain in the fruit or food to cause any ill effects. Even a large dose will do no harm, for the body does not store these compounds.

How soon will you be able to eat and serve food that has been protected by the new insect killers? As soon as the Pure Food and Drug Administration and your own state give the nod. Right now, cotton is the only crop that may be treated legally. Within another year or two, though, UC scientists believe edible crops will also be getting the "nerve gas" treatment. END



Cleaner Stretches Its Neck

THE unfamiliar apparatus above is a new Swedish vacuum cleaner being used to tidy up an apartment building. An extensible light-metal tube carries the suction source up the outside of the building. The man who is doing the actual cleaning taps the tube at whatever floor he's on.

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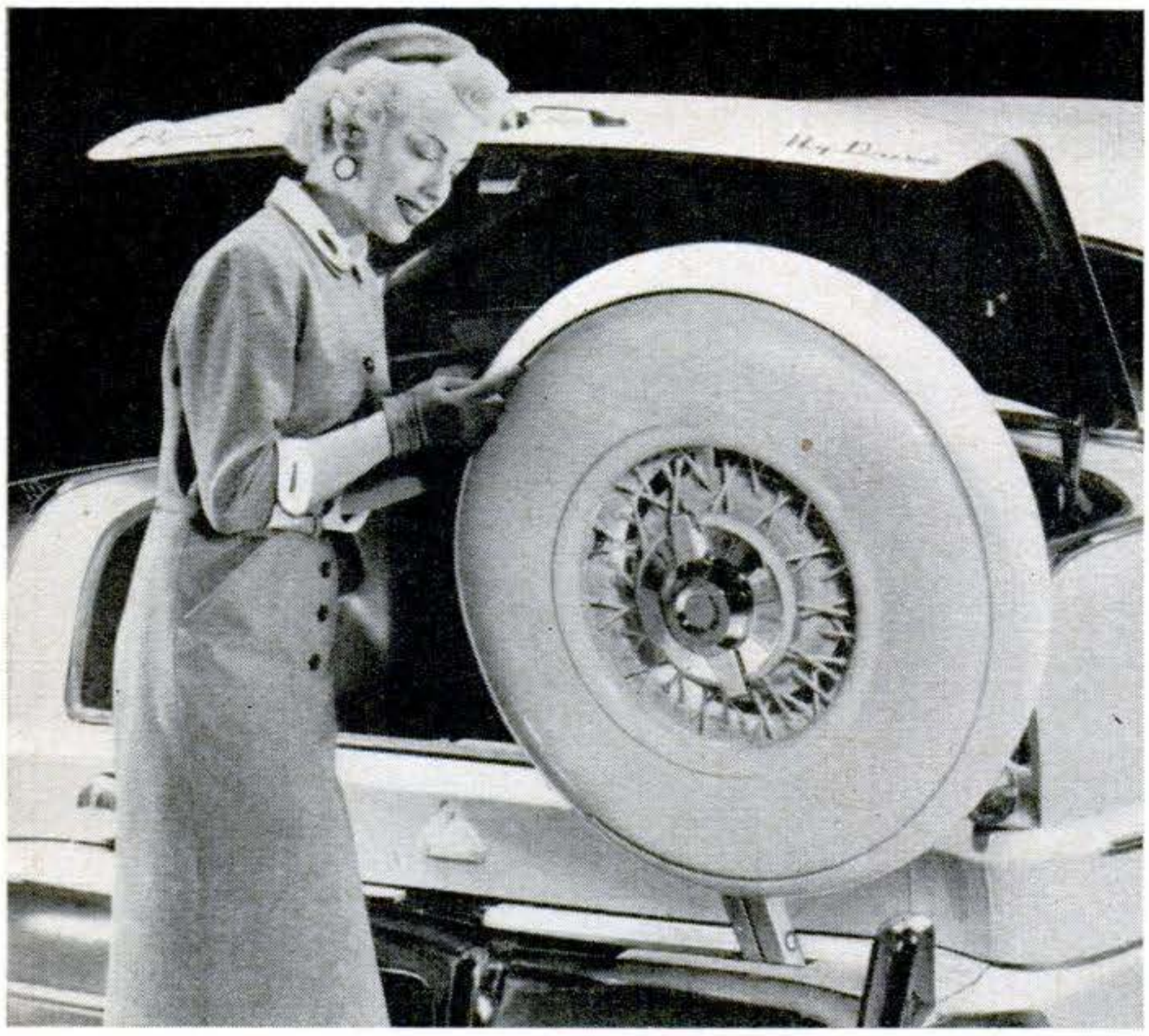


Yankee Ingenuity Adds New Touch to Old-World Styling

THIS spare-tire mount (left), gives a Plymouth a continental look, yet makes access to the trunk easy. Its spring-loaded arm swings off to one side when released by the driver.

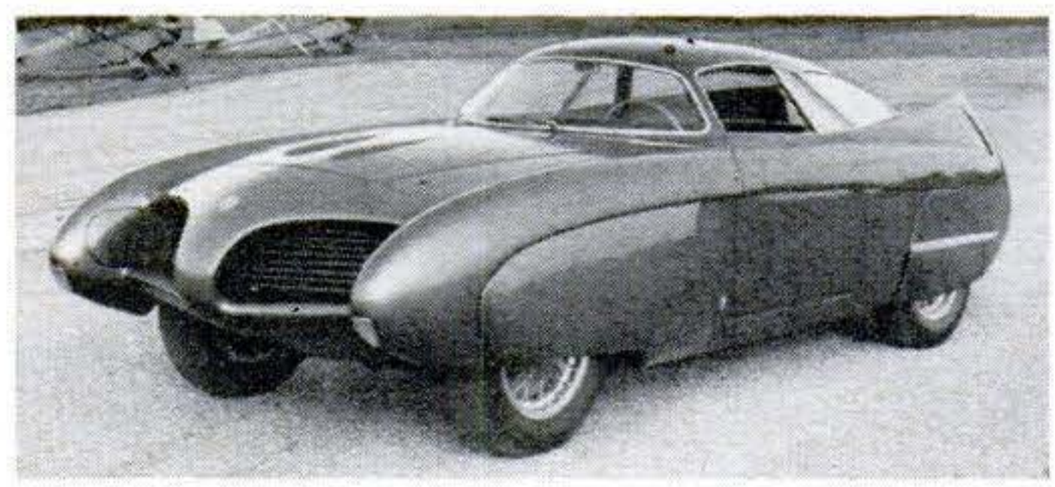
When dropped back into place, the wheel nestles low, giving a sleek appearance and adding eight inches to the car's length. An optional conversion, the mount is installed at the factory.

Propeller Drives Argentine Racer

WITH a propeller at the rear to add push to the engine's pull, the Aerocar at right is claimed to have boosted its speed to 154 m.p.h. The car was built by the Argentine Institute of Aeronautics and Mechanics. Reinhard Horten, one of the inventors of the German V-1 bomb, designed it.

Mercury Shows Low Hardtop

THOUGH currently a one-of-a-kind show car, this XM-800 Mercury Monterey could be placed in volume production, according to Benson Ford. A four-passenger hardtop coupe, it is mounted on a 119-inch wheelbase and is only 55.6 inches high, lower than any U.S. hardtop in present production. Road clearance is seven inches.



Teardrop Car Cuts the Wind

THIS striking B.A.T. 5—a special Bertone body on an Alfa Romeo chassis—is owned by S. H. Arnolt of Chicago. Headlights retract into cooling-duct walls and special skirting minimizes air turbulence at the wheels. Those curved, slotted back fins are to feed air to the drag-inducing "bubble" of low pressure that trails a speeding car.

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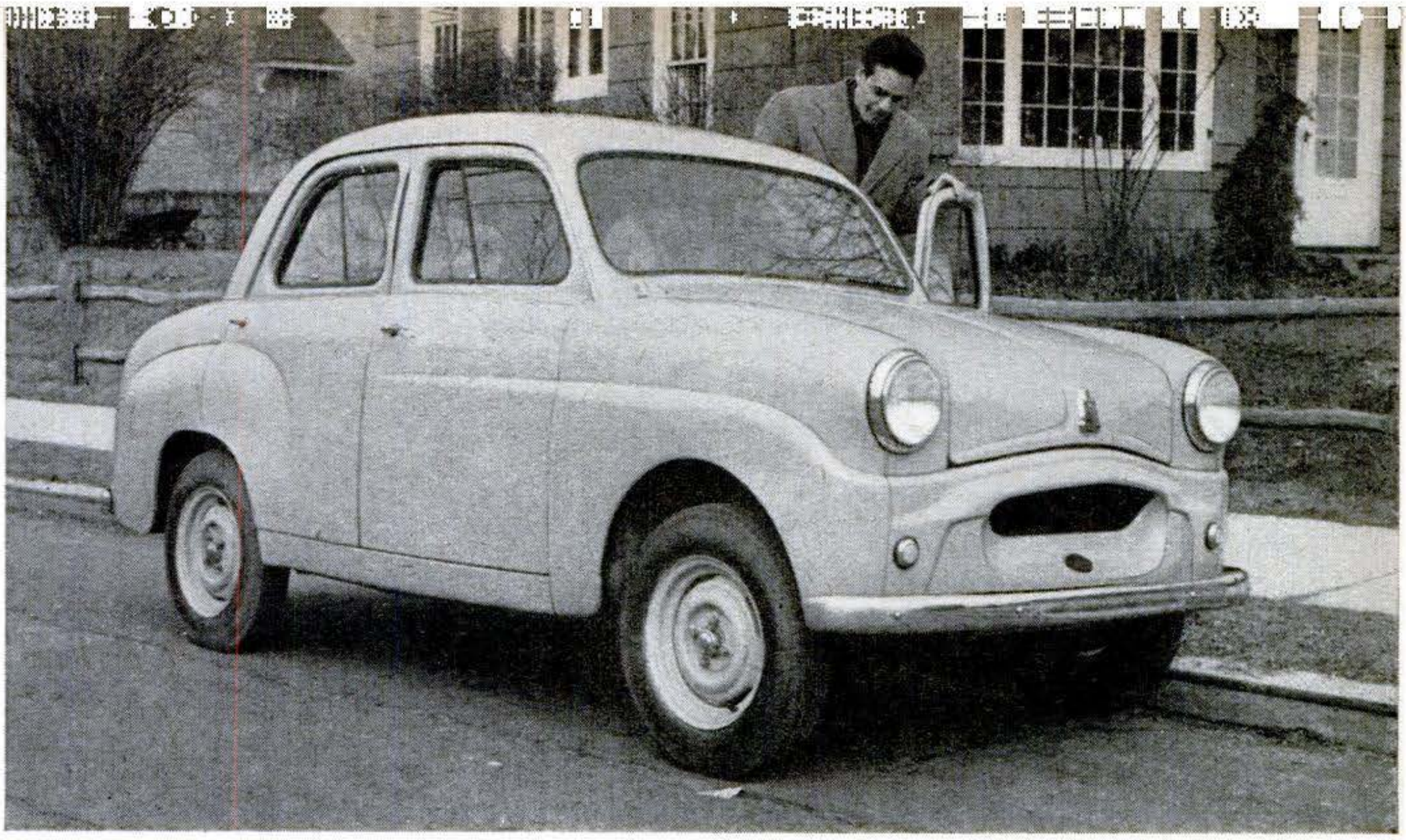
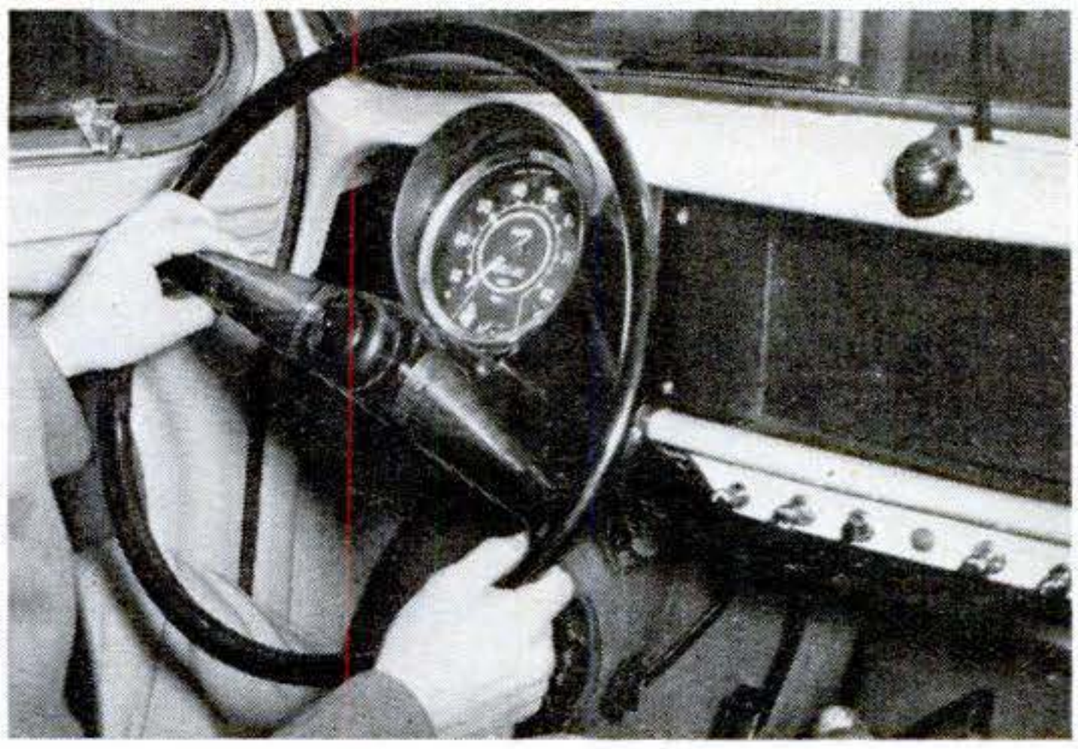


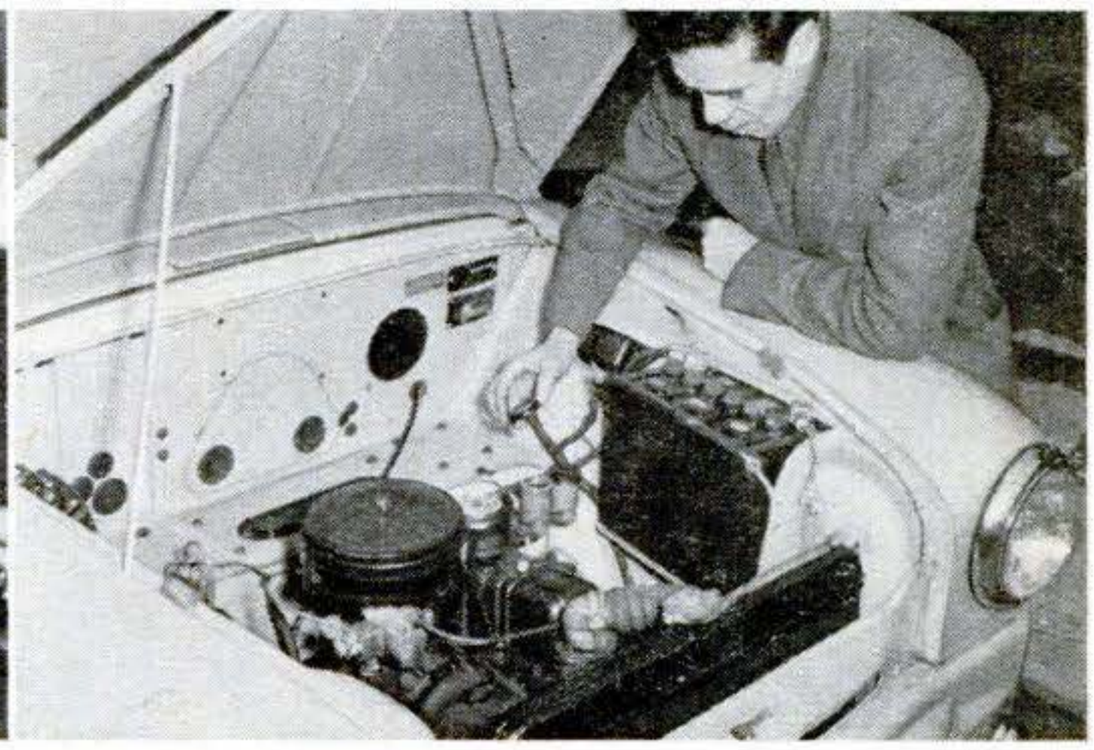
"Lowest-Priced Car" Arrives from Britain

A MITE of an auto from Coventry, England, has landed in the U.S. to challenge all native contenders for the title of "lowest-priced car in America." The new Vanguard Cadet, a four-cylinder, four-door sedan, costs $1,387 at ports of entry.

It is an impressive little performer. Its overhead-valve engine develops only 26 horsepower but whisks the 11-foot 10-inch Cadet over the highways at up to 60 miles an hour. The car, easy to park and turn, averages better than 37 miles to the gallon of gasoline. It has electric windshield wipers, hydraulic brakes and clutch.



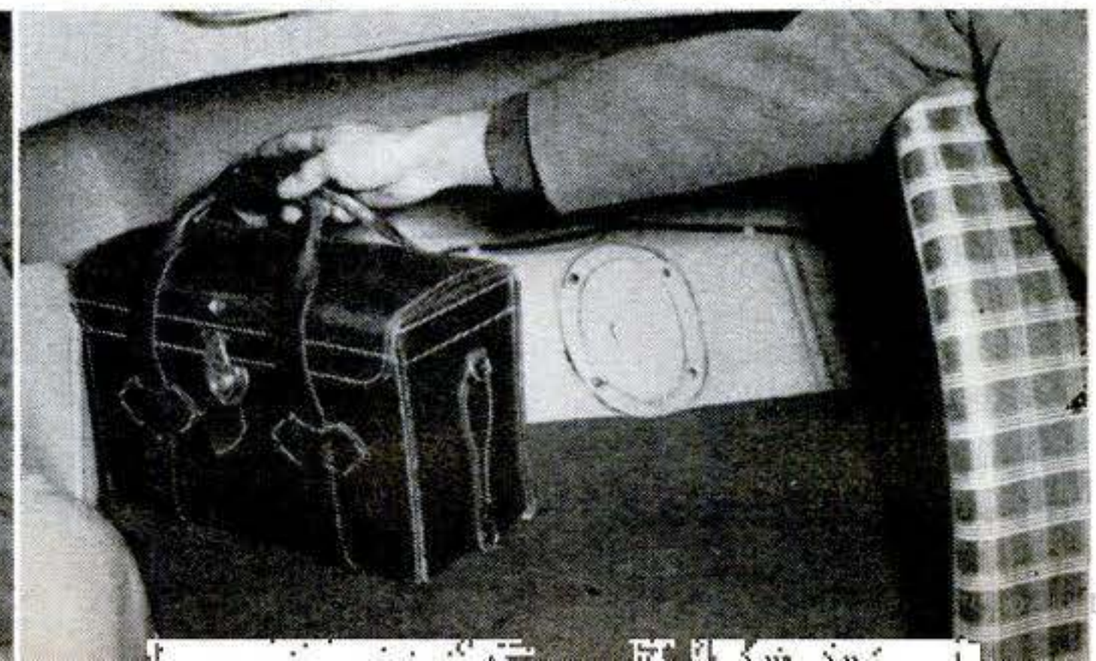
AN AUSTERE DASH groups the instruments in a five-inch dial directly in front of the driver. The parcel shelf could hold a radio.



THE COMPACT ENGINE has a compression ratio of 7.25:1. The car has four forward speeds, and the shift lever is right over the gearbox.

THE SPARE'S IN A SLOT, behind a cover that comes off completely. Cadet's strong, light body and chassis are of unitized construction.

STOWAGE SPACE for luggage is a metal cave behind the rear seats. The seat backs fold forward to provide a large loading platform.

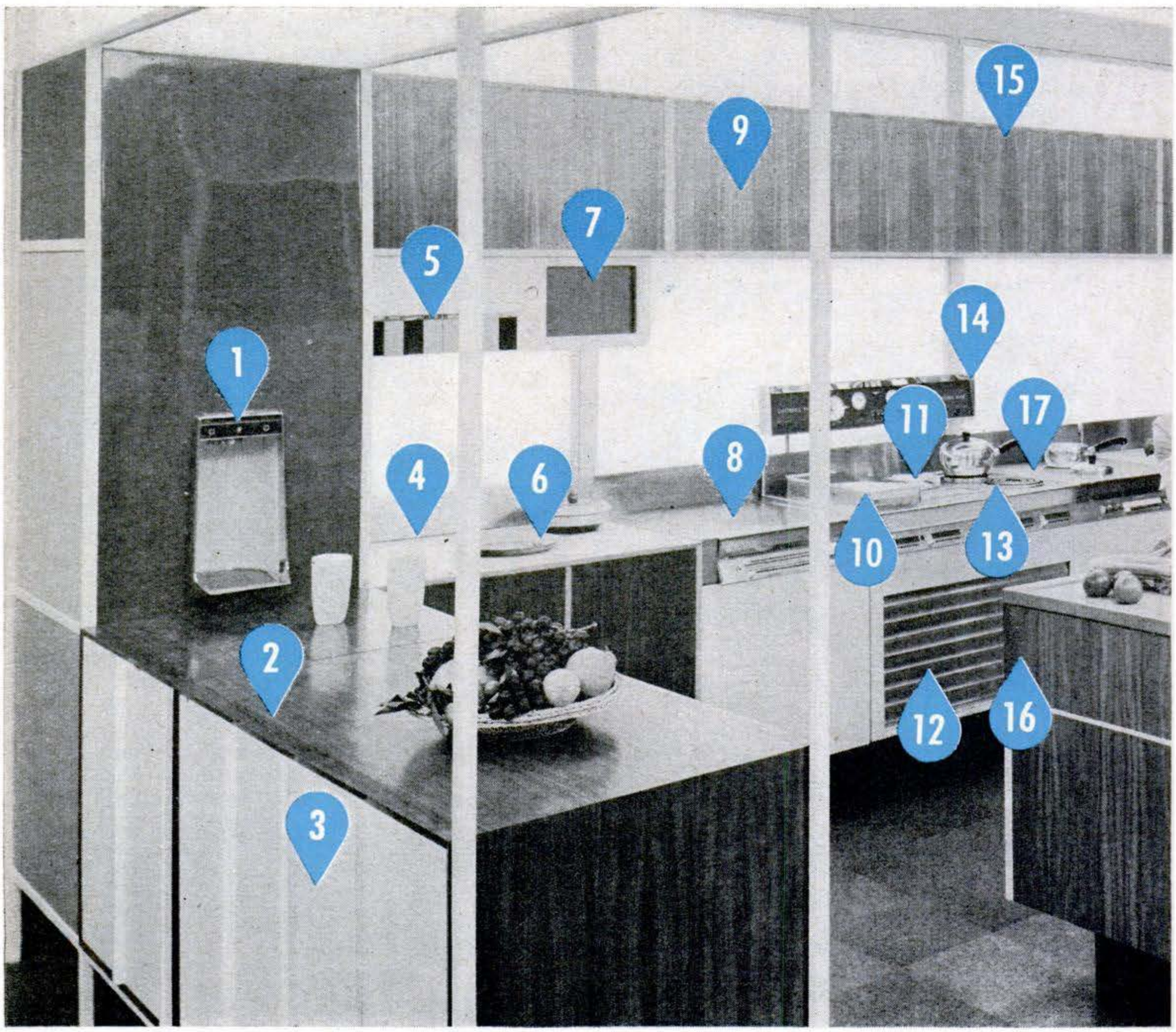


What Would

GRANDMA would probably fling up her hands—and that, of course, would trip the magnetic cabinets that slide down on tracks—if she found herself in the kitchen pictured below. If, in her excitement, she also touched some of the dozens of push buttons, doors would fly open, appliances would pop up from nowhere, and foods would come cascading out of neatly hidden dispensers.

It's General Motors' new dream kitchen, part of the Motorama's traveling entourage of motorized miracles.

In many ways, though, Grandma would feel right at home. Back is her old-time flour hopper, though now with a motorized sifter. Back, too, is her famous spice shelf, motor-driven of course. The idea, says GM, is not to cook the food for you, but to make it easier for



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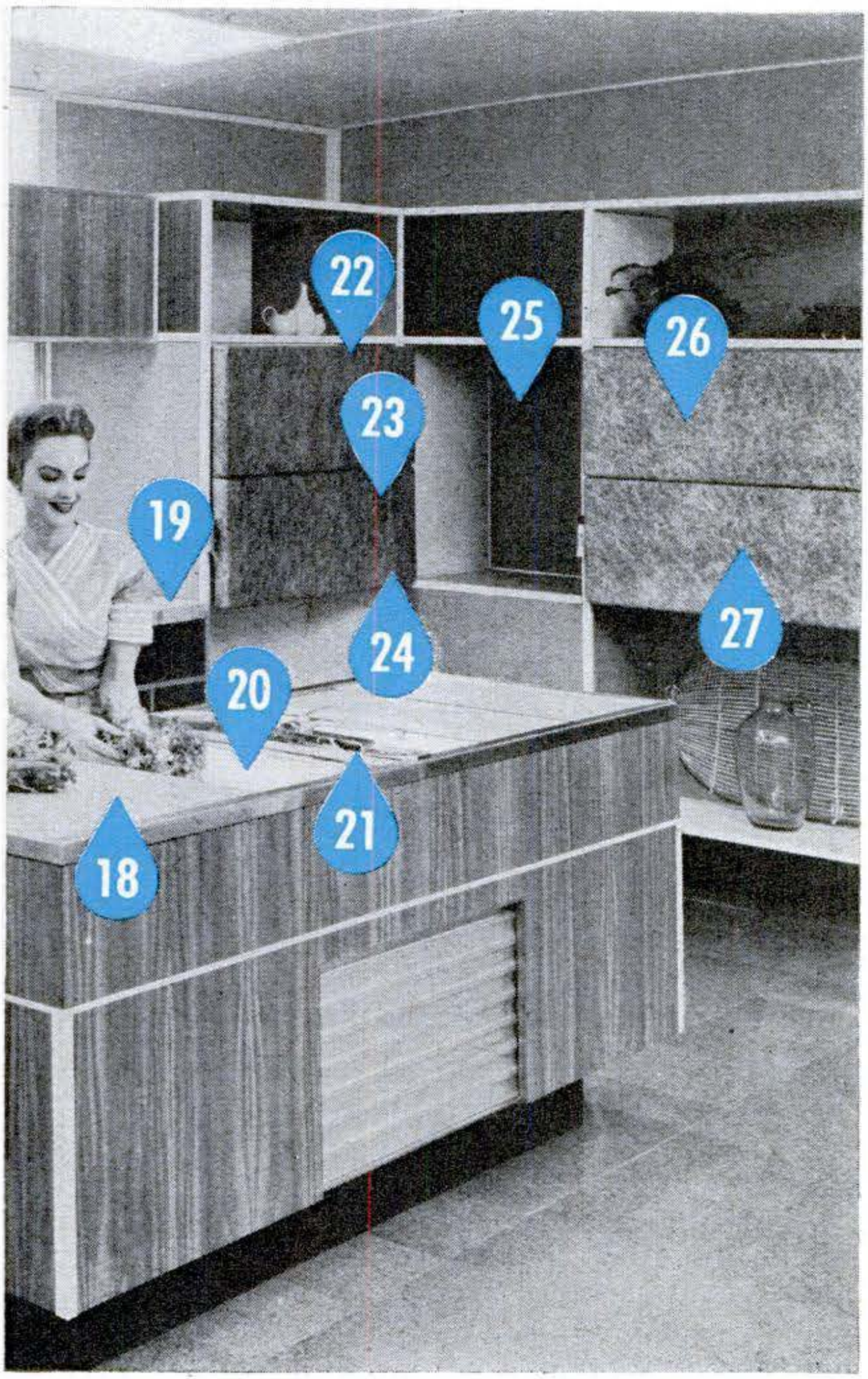
Grandma Say?

you to cook your own food better. In fact, modern housewives are expected to have their hands full—hence, elbow-operated door catches.

When can you buy such a kitchen? Built-in refrigerators and freezers are already on the way, and home-size electronic ovens may not be far off. Mostly, it's a matter of fitting today's wonders to tomorrow's pocketbooks.



...if her kitchen had:

1 *A three-way ice maker to dispense cubes, crushed ice or ice water.*
2 *A serving counter to dining room.*
3 *Cabinets that open from either side.*
4 *An electric mixer that rises out of counter.*
5 *A magnetically held seasoning rack that drops down for use.*
6 *A food blender that rises out of counter.*
7 *A viewing screen to show menus.*
8 *An electronic oven that retracts into counter, cooks food in a few minutes.*
9 *A flour dispenser with a powered sifter.*
10 *A combination Dutch oven and griddle.*
11 *A deep-well cooker built into range.*
12 *A food warmer that keeps meals hot.*
13 *An automatic built-in toaster.*
14 *Clock timers that turn cooking units on and off for pre-set intervals.*
15 *Motorized cabinets that rise and lower.*
16 *An automatic dishwasher in the sink.*
17 *An electric oven that retracts into counter, with a broiler, motor-driven rotisserie, charcolator that passes hickory or charcoal smoke over food.*
18 *The sink in middle of room.*
19 *A motor-driven chopping board that rises to any height for working while standing or sitting.*
20 *An automatic garbage disposer in the sink.*
21 *A faucet that sets both amount and temperature of water.*
22 *A waist-high refrigerator built into wall.*
23 *A compartment that keeps butter soft.*
24 *An egg dispenser inside refrigerator.*
25 *A food-delivery area that can be reached from both sides.*
26 *A horizontal food freezer built into wall.*
27 *A fruit-juice dispenser inside freezer.*

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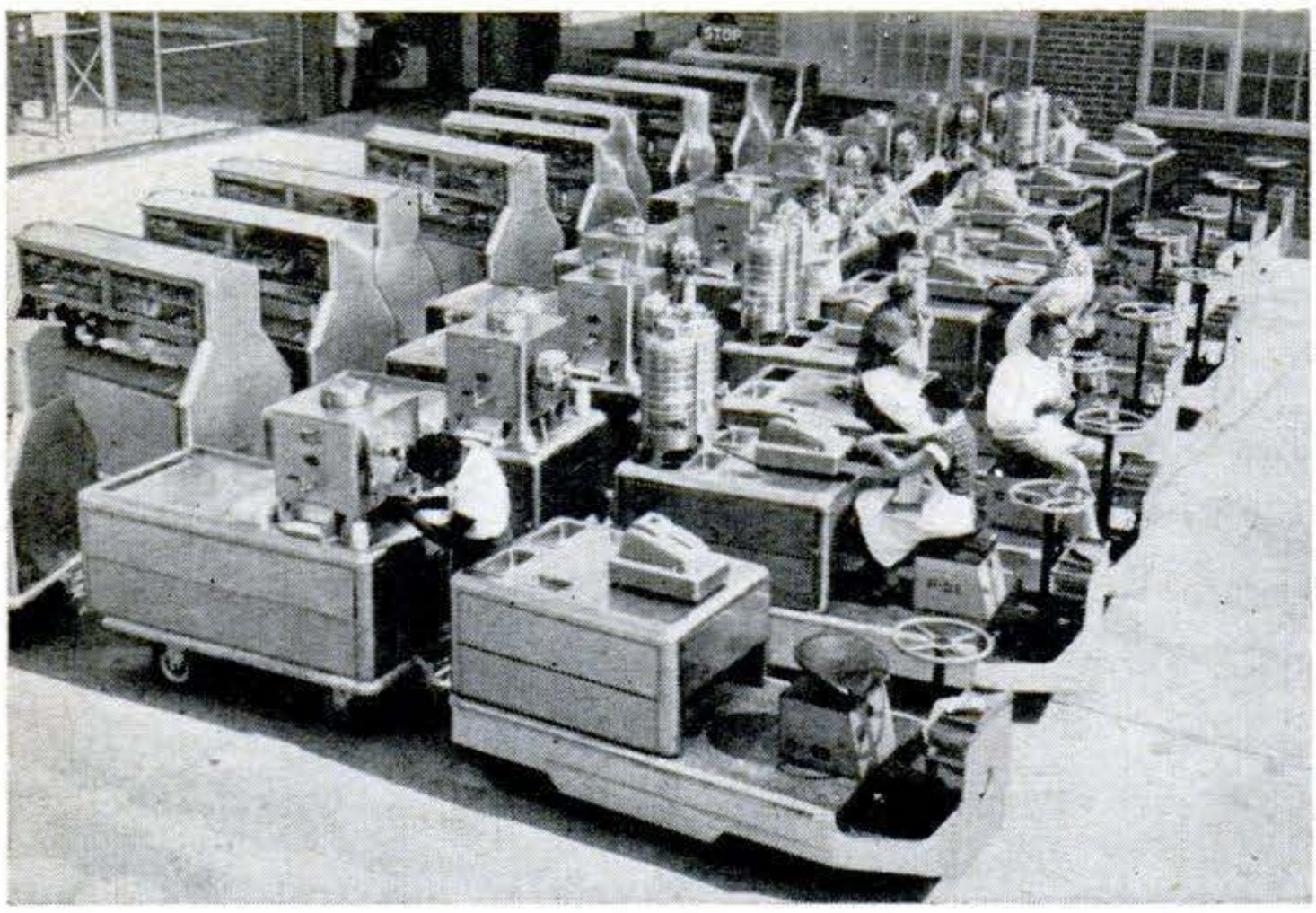
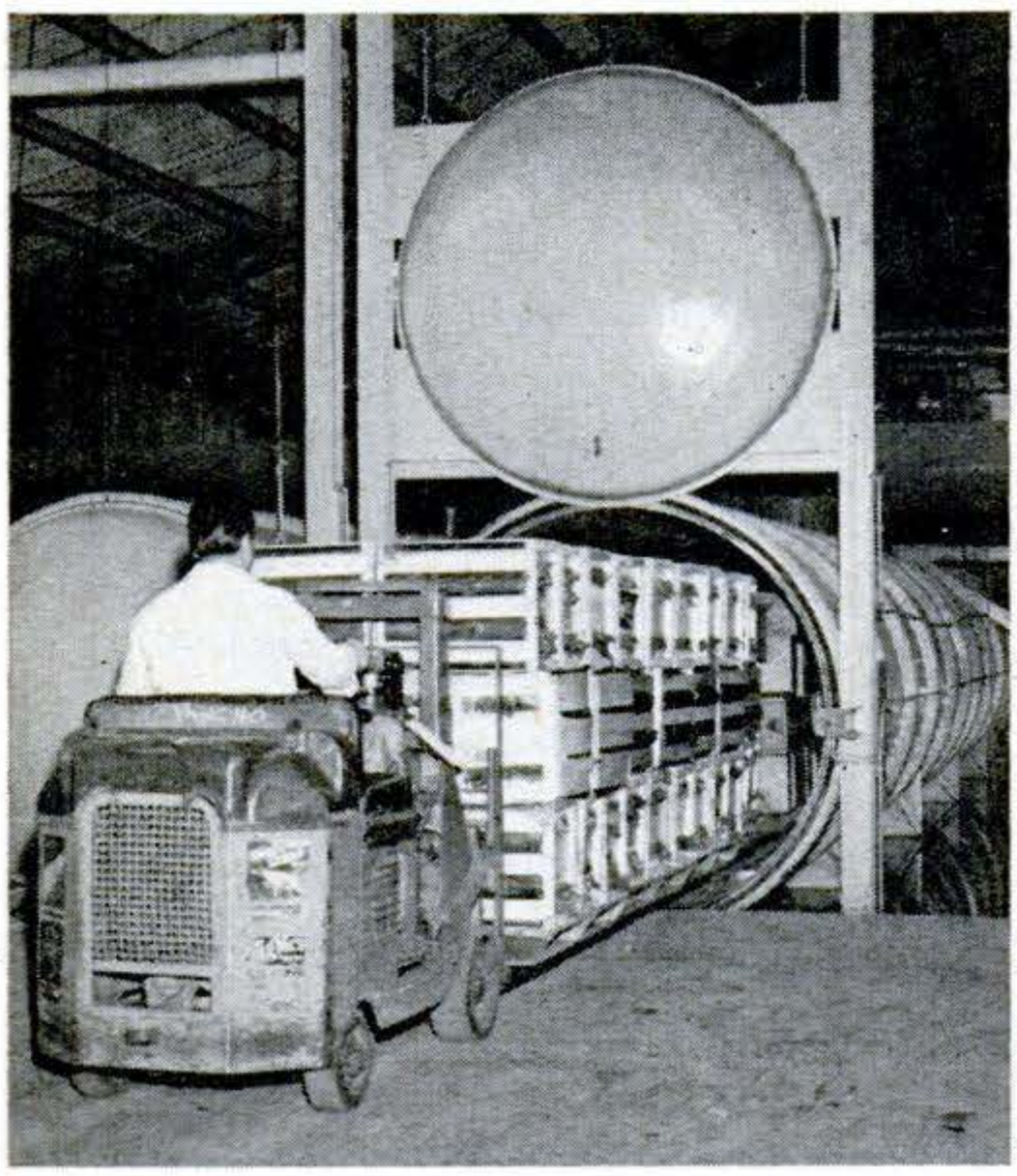


Rolling Cafeterias Serve 3,000 in 12 Minutes

TWELVE trains of cafeteria cars deliver hot meals to Douglas Aircraft workers at El Segundo, Calif. The stainless-steel fleet rolls from the kitchen to 10 dining rooms where the drivers plug in extension cords to keep the food hot. Each train of three carts hauls two coffee urns, two cold-drink dispensers, hot and cold foods, and desserts.

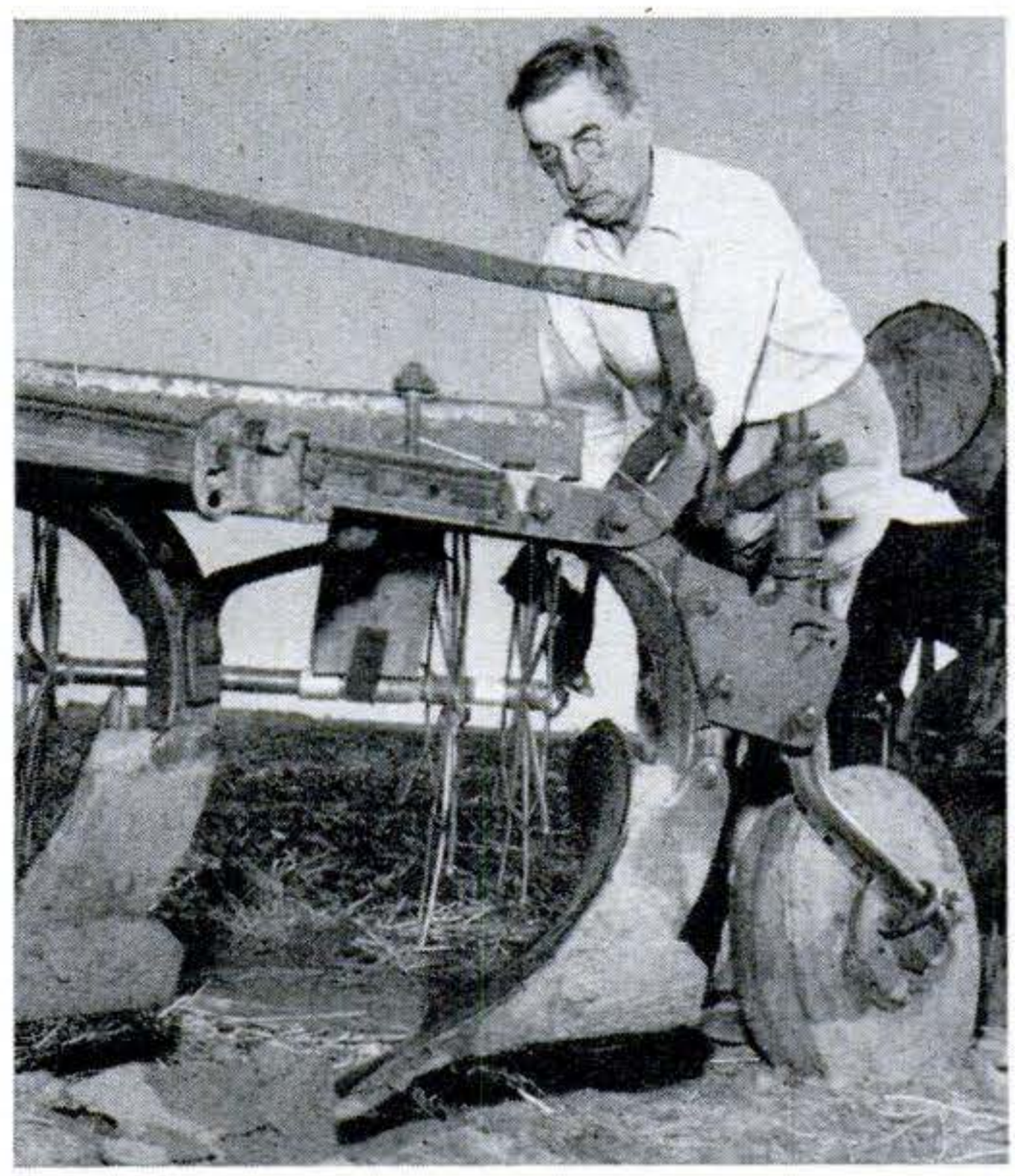
Kangaroo Tie Has Zippered Pouch

THIS tie gives a boy one more pocket for treasures. Bodek Cravat Co., 16 W. 30th St., NYC, says it's for coins or a key.



Quick Chill Keeps Lettuce Crisp

THAT'S fresh-picked lettuce—half a carload—entering the tube above. When the big door comes down, the lettuce will be vacuum-cooled from field temperature to 32 degrees in 30 minutes. Cooled and dried of moisture, it will go direct from the tube to Southern Pacific refrigerator cars outside the packing plant in California's Salinas Valley.



Plow Clears Its Own Blades

MOUNTING spidery spiked wheels on a slim shaft just above the blades of a plow, D. E. Krehbiel, retired grain-elevator operator of Pretty Prairie, Kan., has neatly solved the ancient farm problem of keeping the blades clear of field-strewn straw. The wheels turn as the plowed earth pushes against them, and when they are not needed they can be swung up out of the way.

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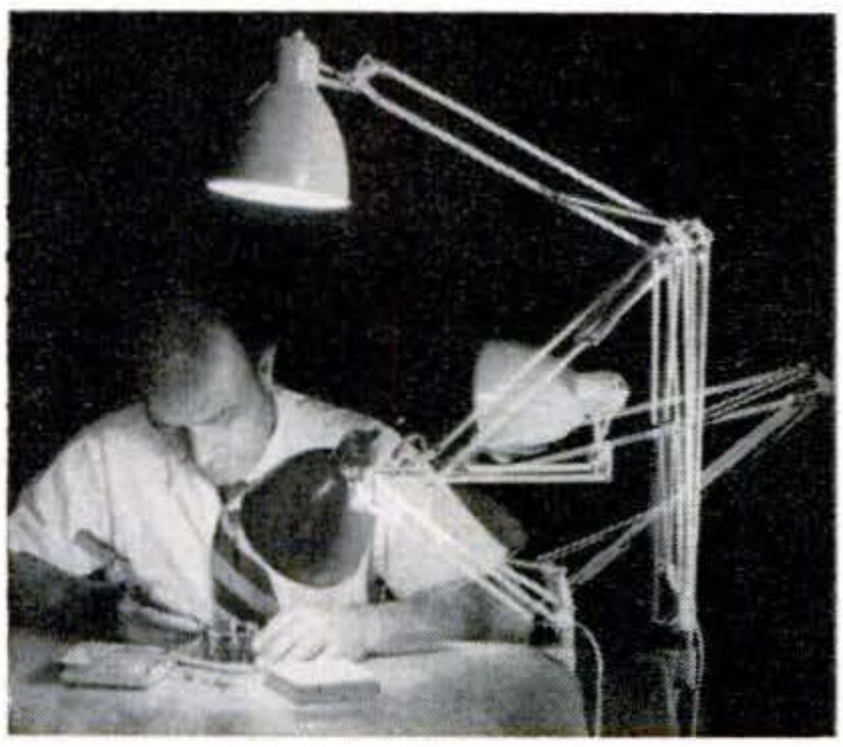
He's Measuring Dew

THIS is not a TV antenna but a dew gauge—a research tool for plant study. Dew is deposited on wood blocks fixed to a central rod at different levels above ground. Shemuel Duvdevani hopes his experiments at Caltech and in Israel will help farmers in dry zones.

▶▶▶How many species of trees grow in the U.S. and Alaska? A nine-year census by the Forest Service puts the count at 1,027.



Lamp Twists Any Way

A TOUCH of the fingers positions this lamp to throw glare- and shadow-free light on your work. Available with a variety of brackets and bases, it can be fastened or set almost anywhere. The Luxo is sold by E. A. Roffman Associates, 303 E. 51st St., NYC 22.

Clock Shows You the Time on Mars

WHEN travelers take off in spaceships, they may check their watches with clocks like this one. The first interplanetary timepiece, it records the hour, day, month and year on Earth and on Mars. The clock divides the Martian year into 12 months—eight of 56 days and four of 55 days. The 24-hour markings around the face indicate Martian time. Actually, the day is about four percent longer than a solar day on Earth, so the hands are geared to move slower than those on the inset Earth dial.

Dr. I. M. Levitt, director of Franklin Institute's Fels Planetarium, invented the clock and Ralph B. Mentzer, Hamilton Watch Co. engineer, built it. Because Hamilton's experimental facilities were tied up in defense work, Mentzer turned out the clock in his home workshop (above) using his own tools and equipment.

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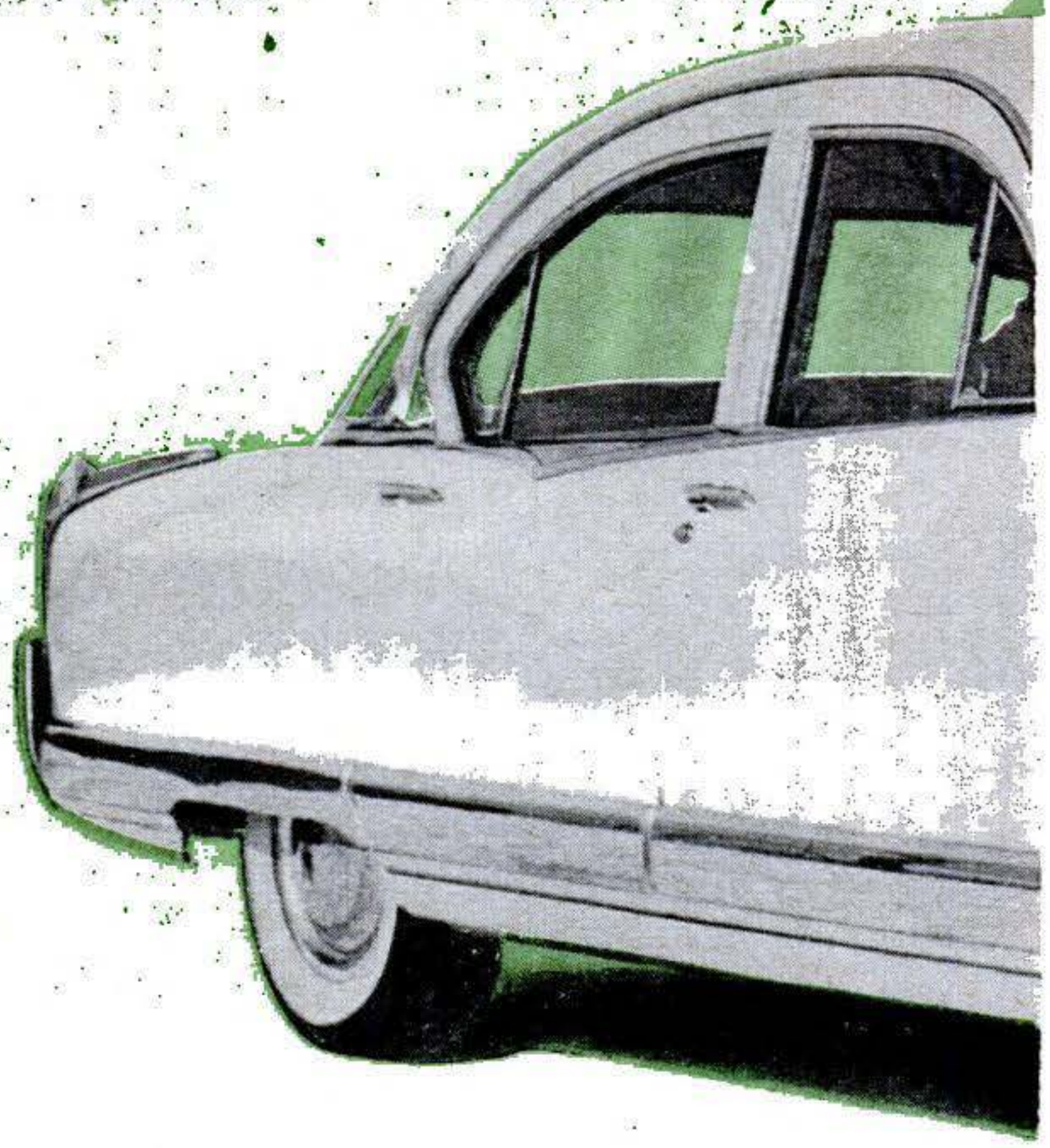
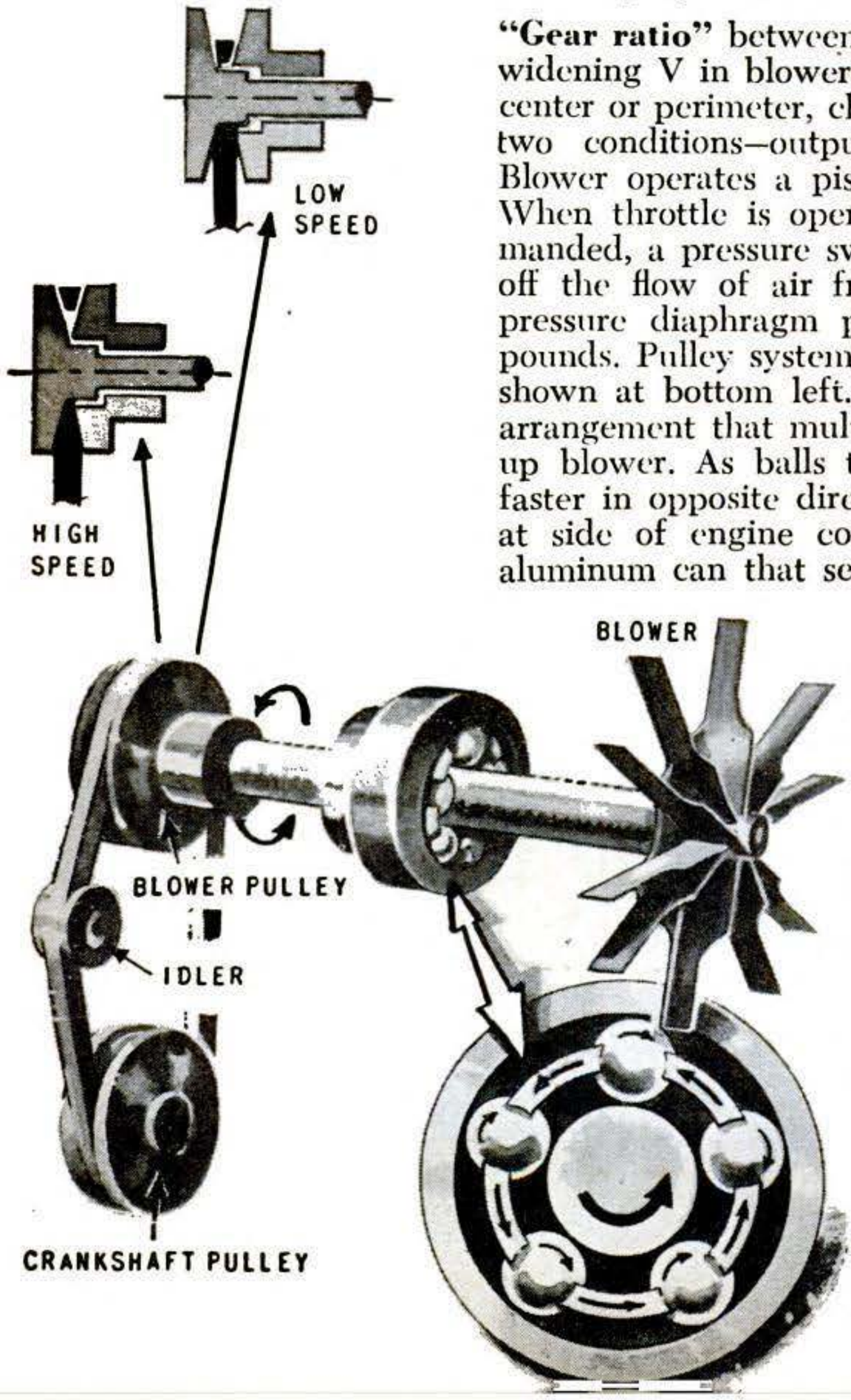
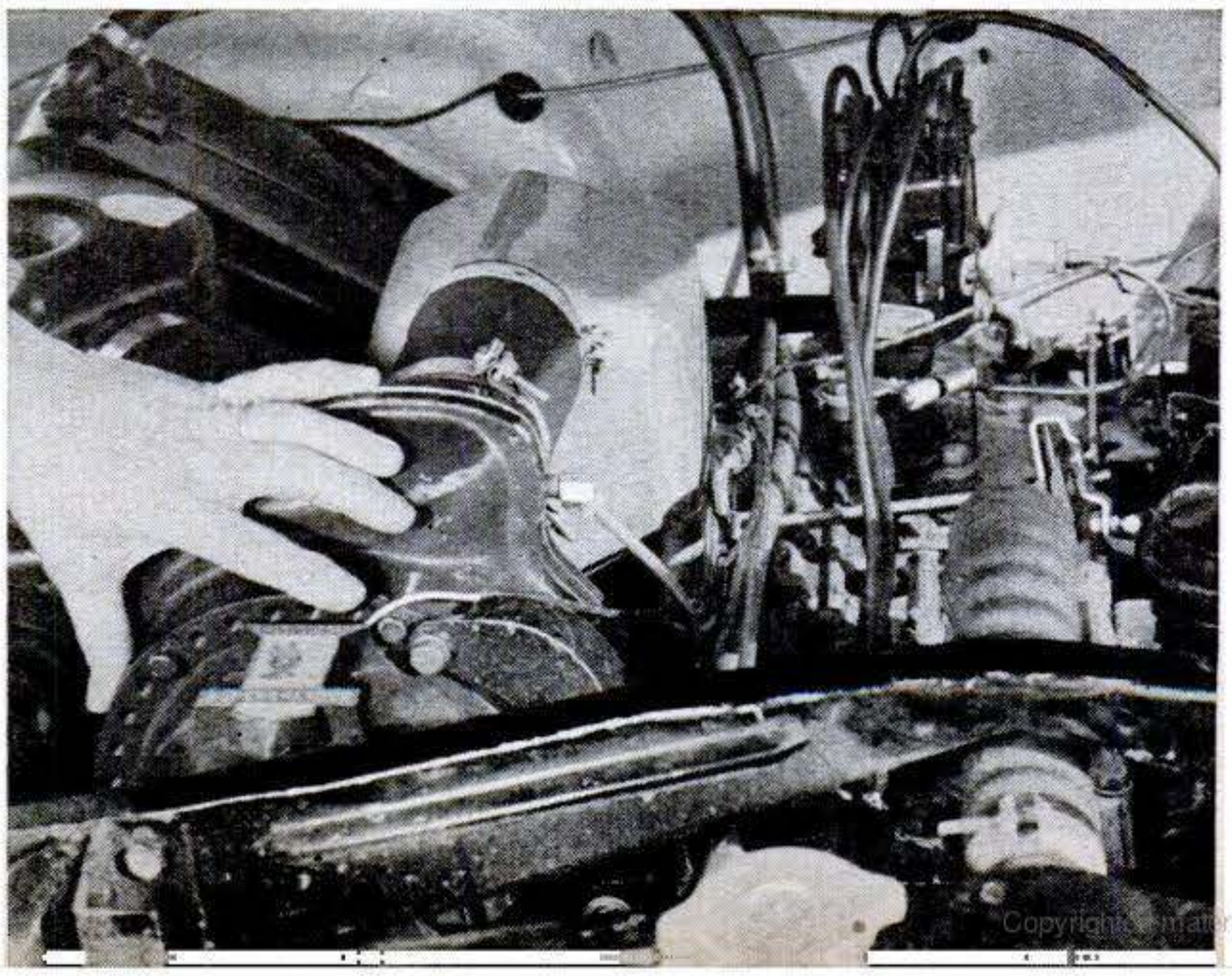


By Devon Francis

Pulleys, Ball Bearings Produce Power



"Gear ratio" between engine and blower is changed by narrowing or widening V in blower pulley (top drawings). This slides belt toward center or perimeter, changing rate of rotation. Width of V responds to two conditions—output of blower and engine manifold pressure. Blower operates a piston that, in effect, governs diameter of pulley. When throttle is opened, however, and high blower pressure is demanded, a pressure switch on manifold actuates a solenoid that shuts off the flow of air from blower to pulley-control piston. A safety-pressure diaphragm prevents blower pressure from going over five pounds. Pulley system and gearless "planetary set" driving blower are shown at bottom left. Next sketch is a head-on view of ball-bearing arrangement that multiplies rate of pulley rotation 4.4 times to speed up blower. As balls turn against outer rim of race, they spin shaft faster in opposite direction. Photo at bottom right is blower installed at side of engine compartment. Behind it is the carburetor in an aluminum can that seals it against normal atmospheric pressure.



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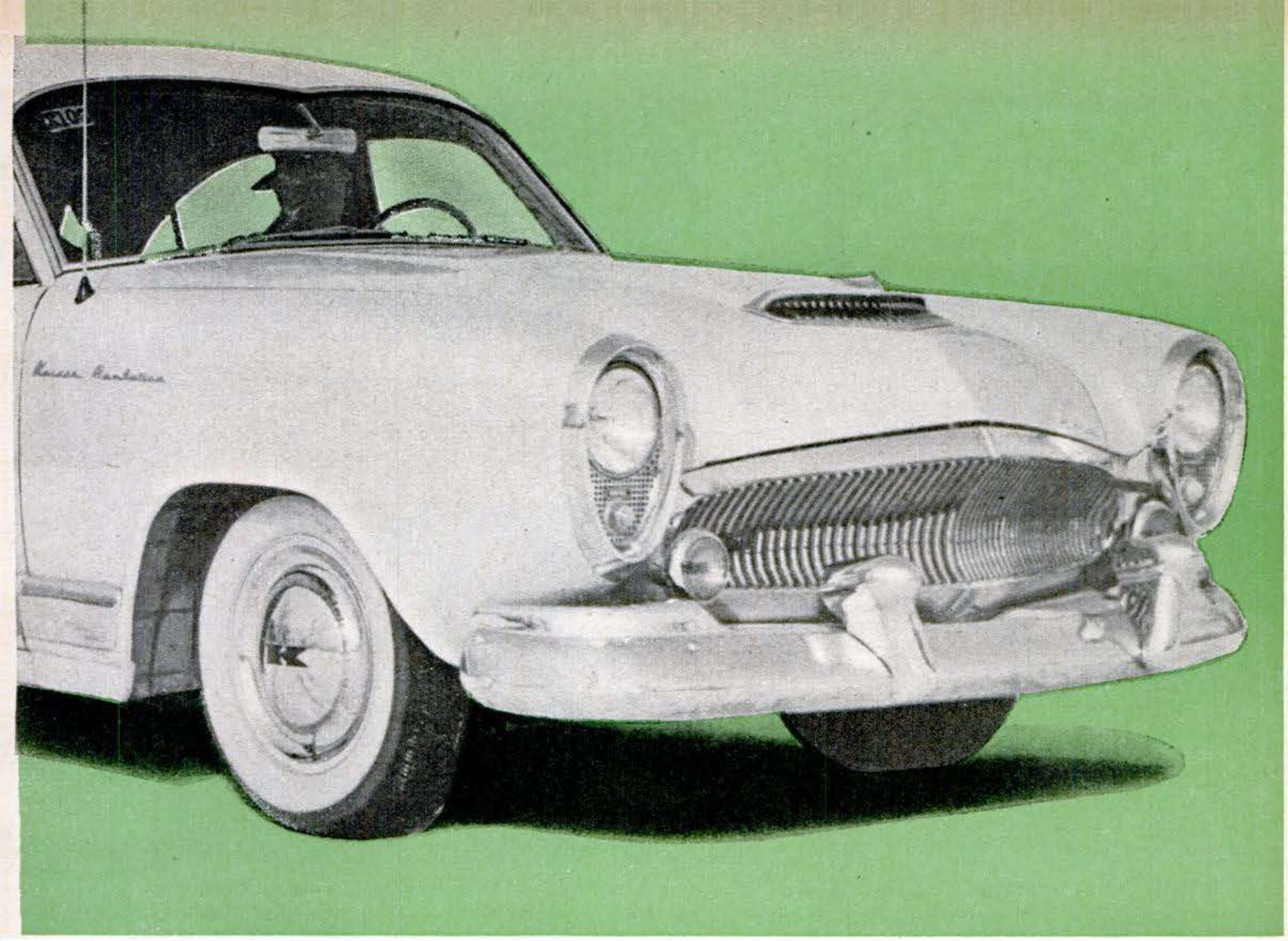

For the first time in 17 years, a U. S. passenger car has been fitted with a blower. Result: 22 more horsepower.

WHEN the new Kaiser cars had their wraps taken off in the dealers' showrooms the other day, they had something that the nation's hot-rodders have been clamoring for all along—a factory-installed supercharger.

After driving the 1954 Kaiser Manhattan, I have an idea that it is going to appeal to a lot of people who wouldn't know a drag strip from a drachma. Ordinary citizens, ignorant of the exotic aspects of motoring, will grow to like supercharging, too.

I was incredulous when I felt the added boot at the rear wheels of the new Kaiser. It beat last year's Kaiser—with an identical but "unblown" engine—for instance, by more than seven seconds in accelerating from zero to 60 miles an hour.

The introduction of a supercharger on a U. S. production automobile for the first time in 17 years came about through a neat combination of two circumstances:

An aircraft-type supercharger for automobiles had just come on the market, and Kaiser wanted more horsepower without the headaches of redesigning an engine.

Blower Gives Old Engine New Life

By blowing its engine, Kaiser has managed to suck 22 more horsepower out of a modest-sized L-head six normally rated at 118. While practically everybody else in the industry was whipping engines into a lather in the horsepower race, Kaiser quietly slipped in with a fresh and creditable performance with a power plant design basically eight years old.

Supercharging is an inexpensive way of subcutaneously injecting more oomph into an automobile. Here is the performance, in seconds on a stopwatch, that I racked up with an untuned 1953 Kaiser

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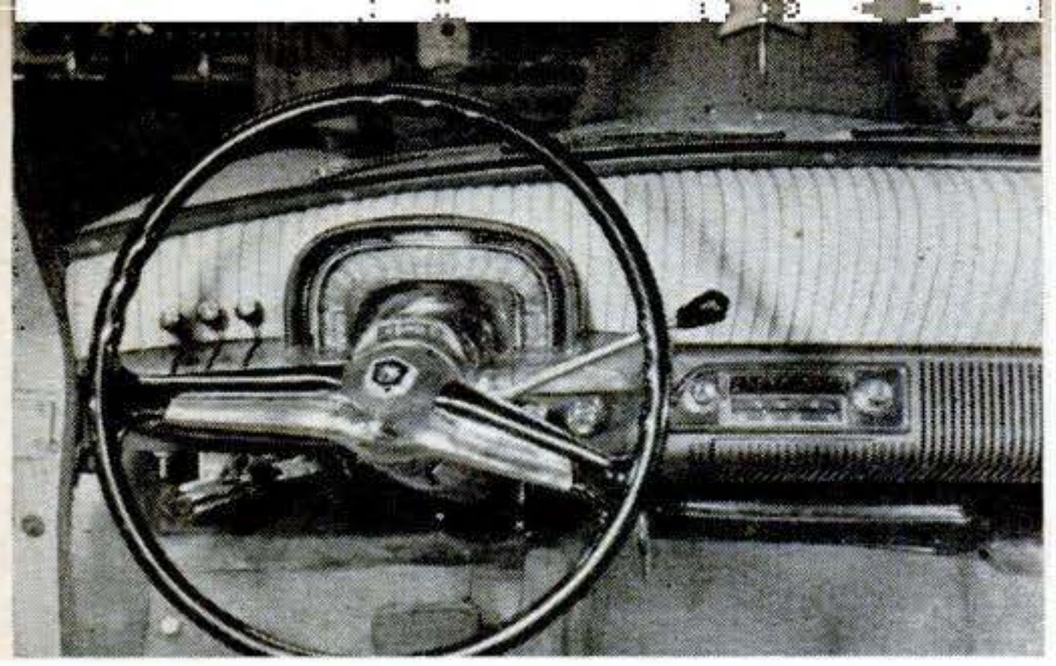
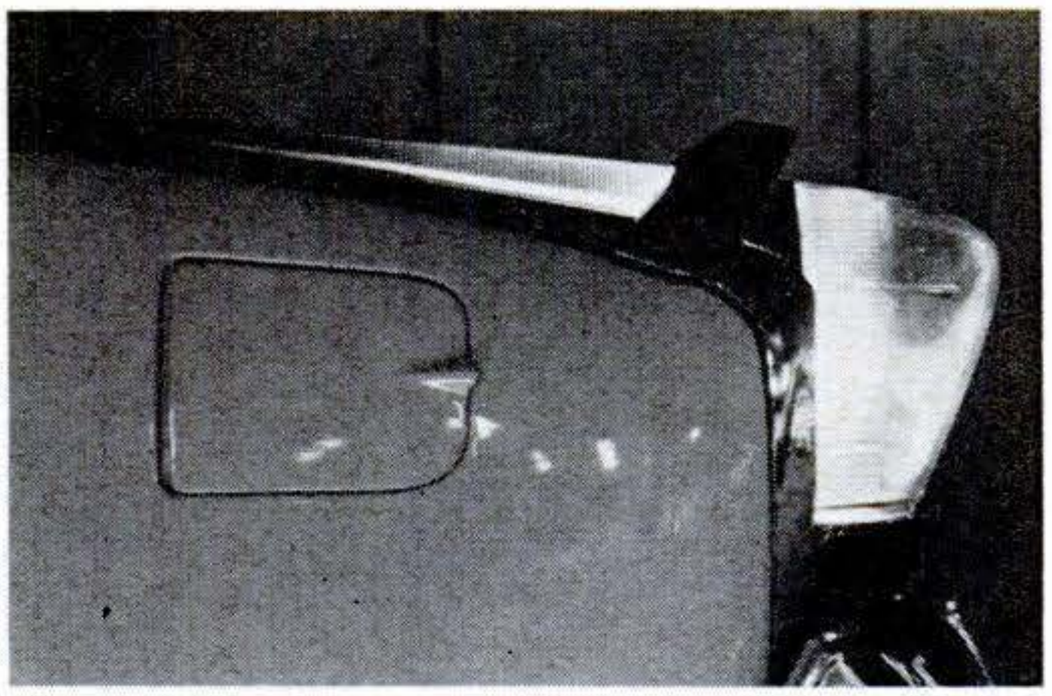


REDESIGNED PANEL centers instruments in front of driver. Ventilating controls are of airplane type. Lowered hood lets the driver see ground only 15½ feet in front of car.

CRASH PAD above instrument panel is duplicated on back of front seat for rear-seat passengers. Famous for its trims, Kaiser for '54 has some of industry's richest fabrics.

REAR-WINDOW DEFROSTER is simple heating-coil unit with fan. Wrap-around design gives Manhattan total of 3,964 square inches of glass area, slimmed-down support posts.



GLOW AREA of tail lights has been extended into modified fishtail, providing added warning when seen from side. Additional lighted portion is 18 inches long, 1⅝ high.

and a 1954 Kaiser that had not yet been broken in:

	1954	1953
0-60 m.p.h.	14.6	21.9
0-80	26.1	43.6
40-60	9.3	16.9
40-80	22.0	35.7

The Kaiser blower, standard equipment on the Manhattan, is made by McCulloch Motors Corp., Los Angeles (PSM, Dec. '53, p. 168).

The sole function of a blower is to cram more air into the cylinders. That boosts the compression and makes the fuel burn better. Hence, more power. Blowers have been used now and then on production automobiles since early

[Continued on page 272]

FACTS ON '54 KAISER

Model: Manhattan 4-door sedan.

Engine: 6-cyl. L-head; 140 hp. at 3,800 r.p.m. (with supercharger); compression ratio, 7.3:1; piston displacement, 226.2 cu. in.; bore and stroke, 3 5/16" by 4⅜"; piston travel (in feet per car mile at 20 m.p.h.), 1,790; crankshaft bearing surface, 44.6 sq. in.; torque, 215 lb.-ft. at 2,600 r.p.m.

Weight: 3,491 lb. (dry); per hp., 24.9 lb.

Transmission: Hydra-Matic; rear-axle ratio, 3.31:1.

Steering ratio: 15.1:1 (with power steering); radius of turning circle, 19'.

Effective brake-lining area: 176 sq. in.

Springs: front, coil; rear, semi-elliptic.

Outside dimensions: height (loaded), 60.25"; over-all length with bumpers and guards, 215.62"; width, 74.87"; wheelbase, 118.5"; overhang, front 42.38", rear 54.75"; tread, front 58", rear 58.7".

Inside dimensions: seat-cushion width, front and rear 63.1"; leg room, front 45.3", rear 39.6"; headroom, front 35.7", rear 33.7"; seat height, front 11", rear 12.7"; vertical distance, steering wheel to seat cushion with seat in mid-position, 5.5"; front-seat adjustment, horizontal 7", vertical 15/16".

Tire size: 6.70 by 15.

Price: $2,453.53 at Detroit, without state or local taxes.

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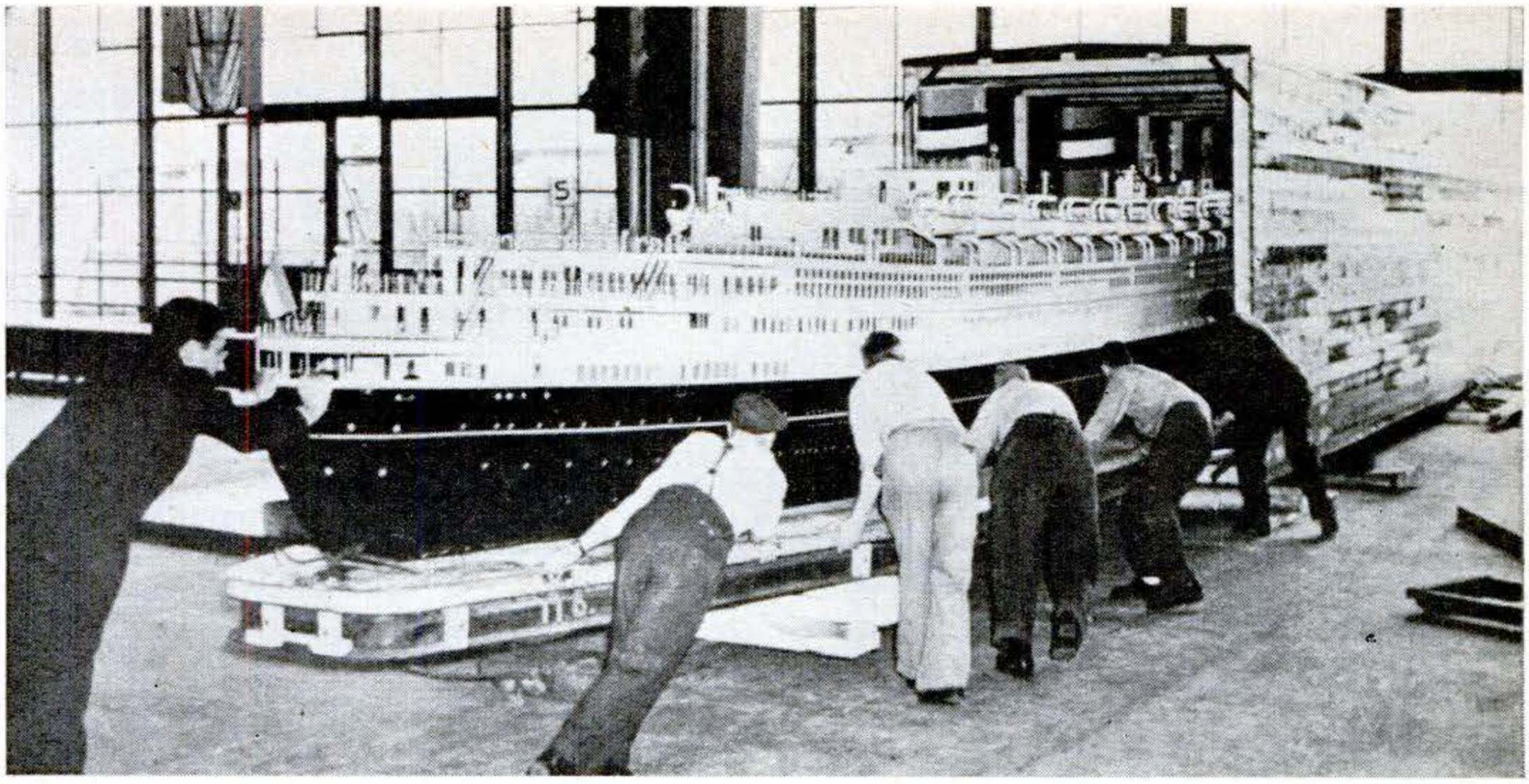
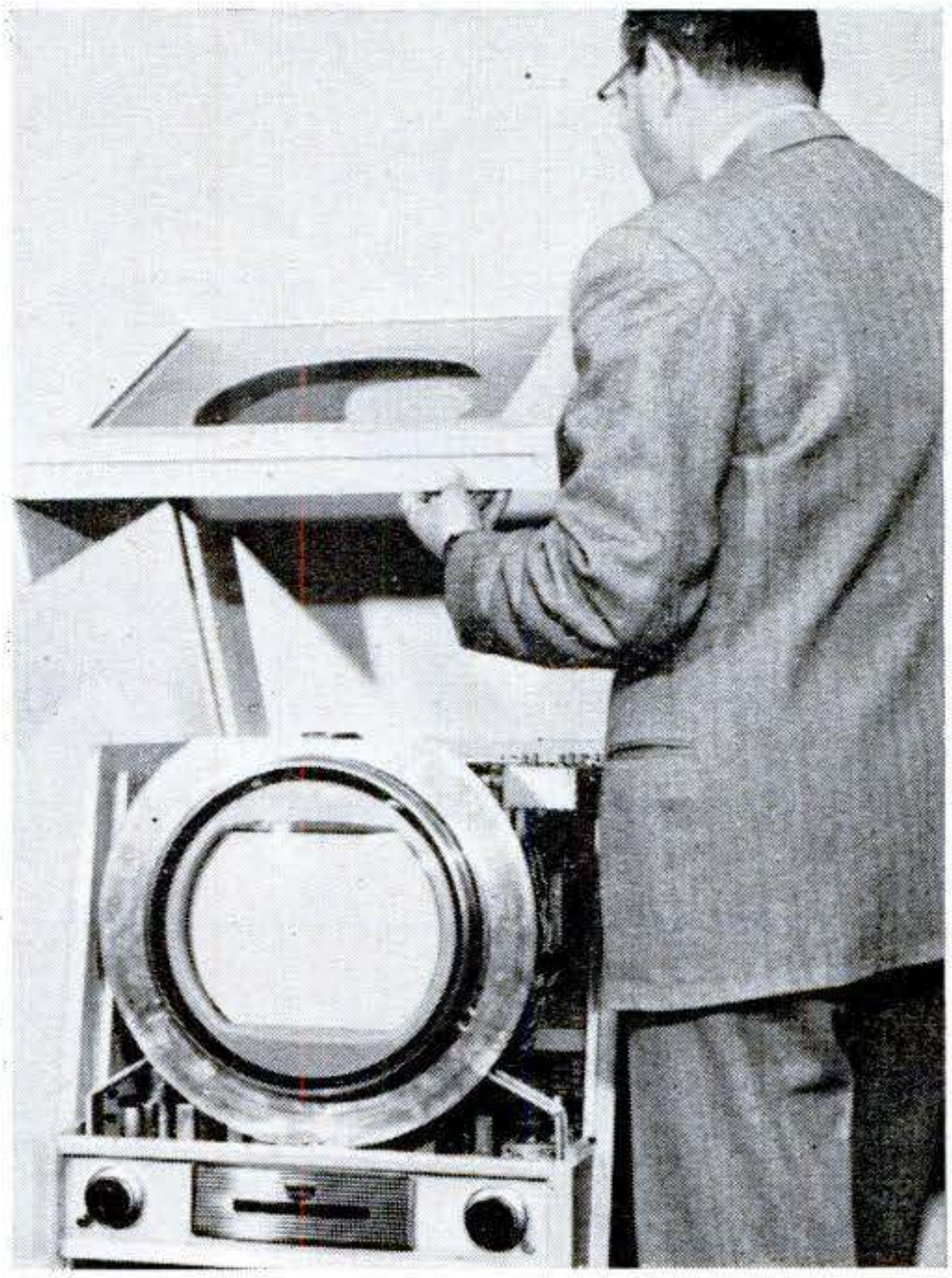


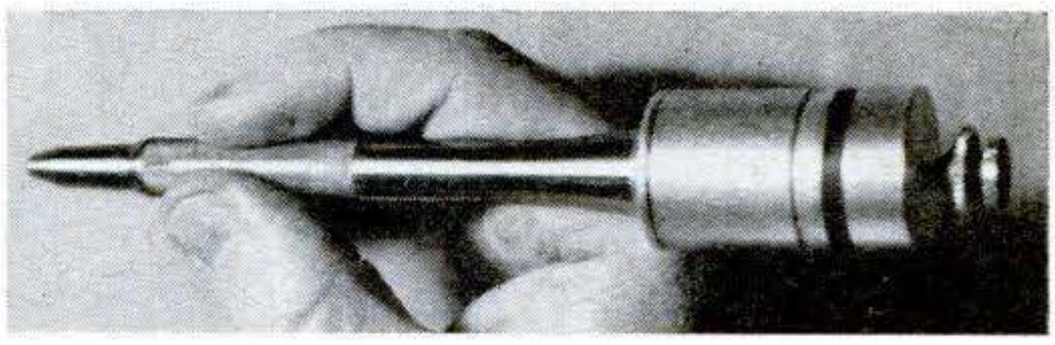
World's Largest Ship Model Is Crated for Ocean Voyage

MANY a real yacht is not much bigger than this ship model. Forty feet long and weighing 1½ tons, it is a 1/20-size reproduction of the SS *Nieuw Amsterdam*, flagship of the Holland-America Line. It is shown being crated in Rotterdam to cross the ocean to the National Sports and Boat Show in San Francisco.



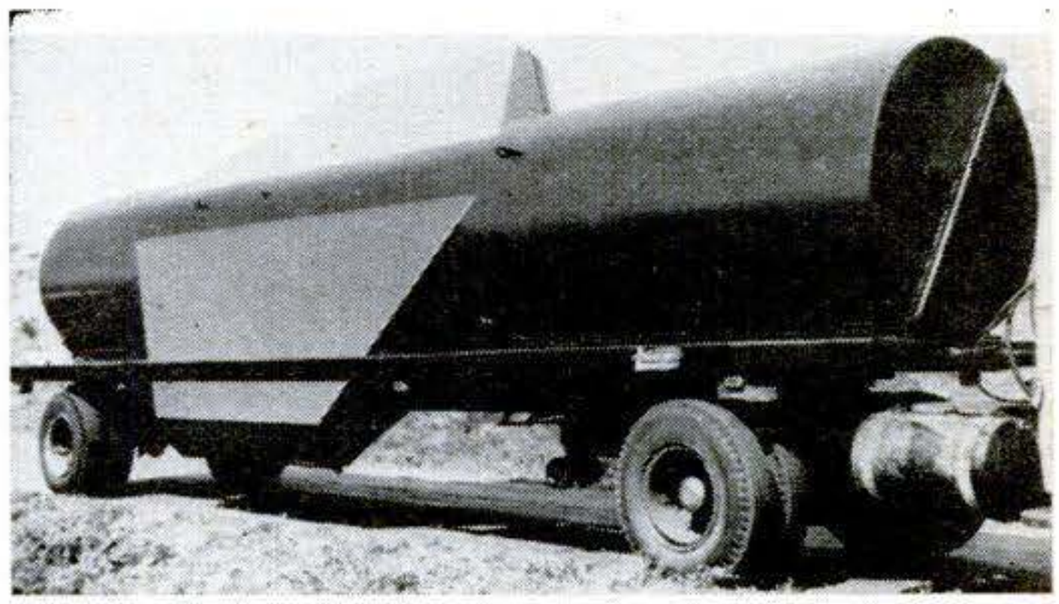
Color TV Set Flips Its Lid

THE top of one new color TV set lifts off without tools to expose the chassis for easy picture-tube adjustment. A "color killer" cuts out color circuits automatically when black-and-white telecasts come in. An Admiral, the set sells for $1,175.



Dental Drill Runs on Battery

ARMY dentists can buzz away on a soldier's teeth far from power lines with this drill. Devised by University of Michigan researchers for field use, it carries its own motor and operates off a Jeep battery.



Missiles Ride Odd Trailer

THAT'S not an oil truck above but a guided-missile toter. The cylinder opens to take the missile, then rotates to keep its 12-foot-wide load within road clearances. Spencer-Safford Loadcraft, Inc., Augusta, Kan., built the trailer for Chance Vought.

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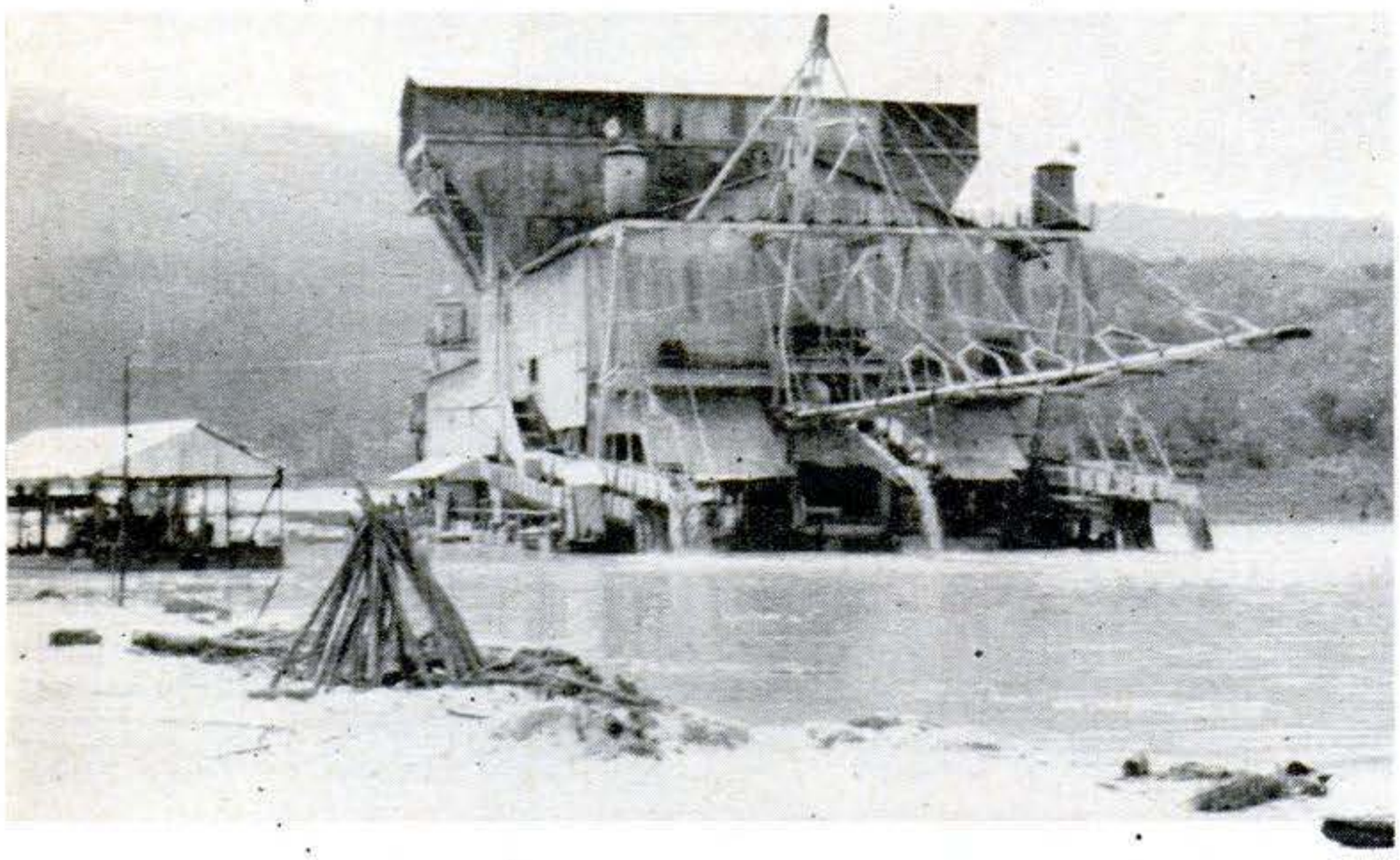

Armed Dredge Guards Miners

GUERRILLA snipers give tin mining in Malaya something of the atmosphere of a cowboys-and-Indians movie. Heavy armor guards the miners working this giant dredge at the Rawang mine at Serendor. The three turrets visible atop the dredge superstructure are steel-protected machine-gun positions, the U.S. Bureau of Mines reports. Each turret also has a searchlight.

Tiny French Jet Can Land at 45

THE first French delta-wing jet—perhaps the world's smallest—is being flight-tested. Called the Payen Pa 49, it has a wing span of only 20 feet and a top speed of only 250 miles an hour. But it lands at 45. The Palas gas-turbine engine produces a mere 352 pounds' thrust—U. S. turbines go up to 10,000 pounds.

They Say Now .....

DR. SPAFFORD ACKERLY, UNIVERSITY OF LOUISVILLE: *"Too often the aged accept their aches and pains as normal for that age. They are not normal... Let the old people... gripe on all the problems that affect them. That is the only way we are going to make progress in the treatment and prevention of these problems."*

DEAN GEORGE R. HARRISON, MIT: *"Science is the greatest agency yet discovered for changing things to what they ought to be."*

PROF. MILTON E. PARKER, ILLINOIS INSTITUTE OF TECHNOLOGY: *"By 1957, the United States must boost agricultural production by the equivalent of 115,000,000 acres just to feed and clothe the predicted increased population."*

EZRA TAFT BENSON, SECRETARY OF AGRICULTURE: *"The research of today shapes the welfare of our country tomorrow . . . Truly, knowledge pays the best interest."*

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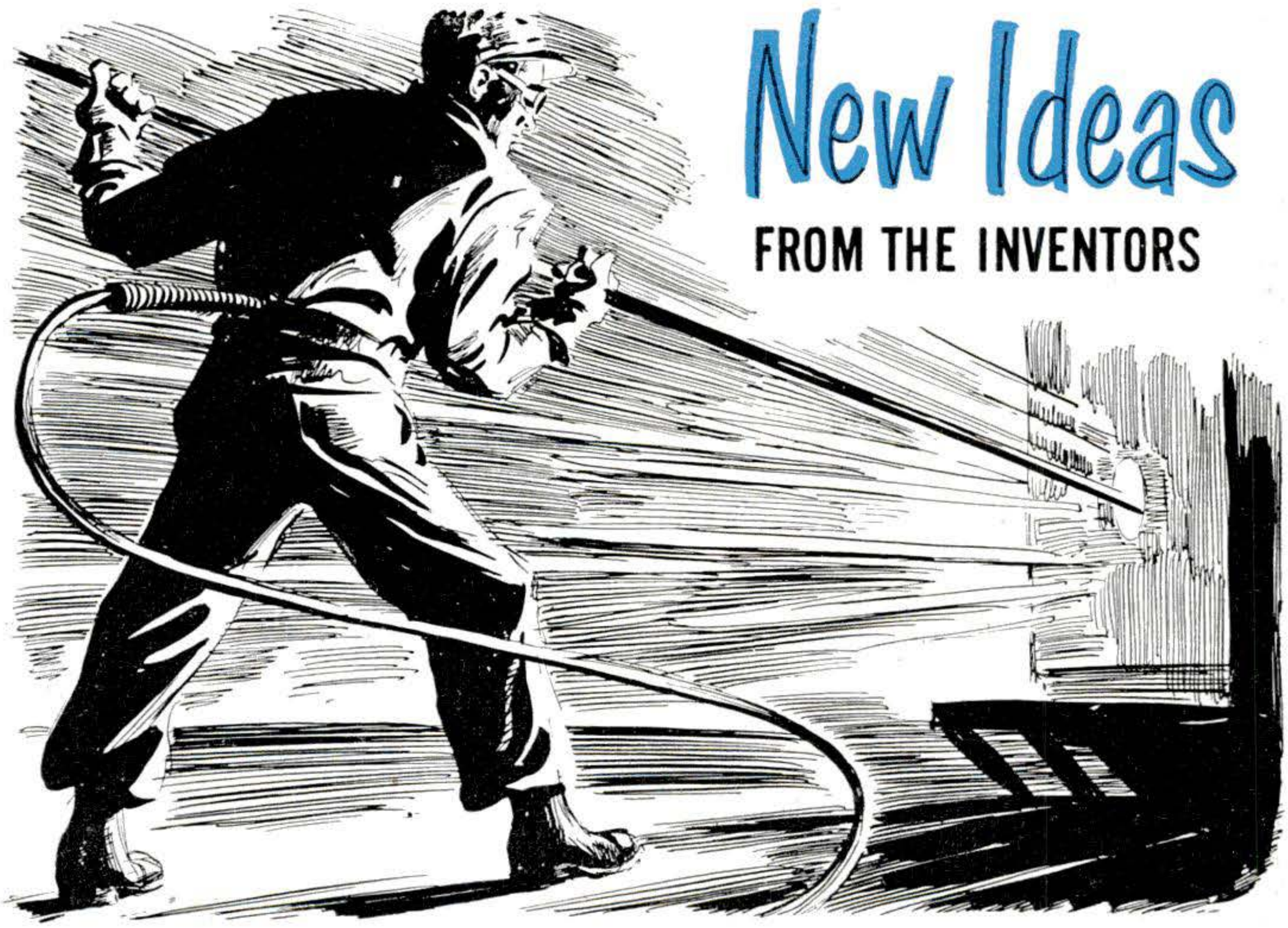
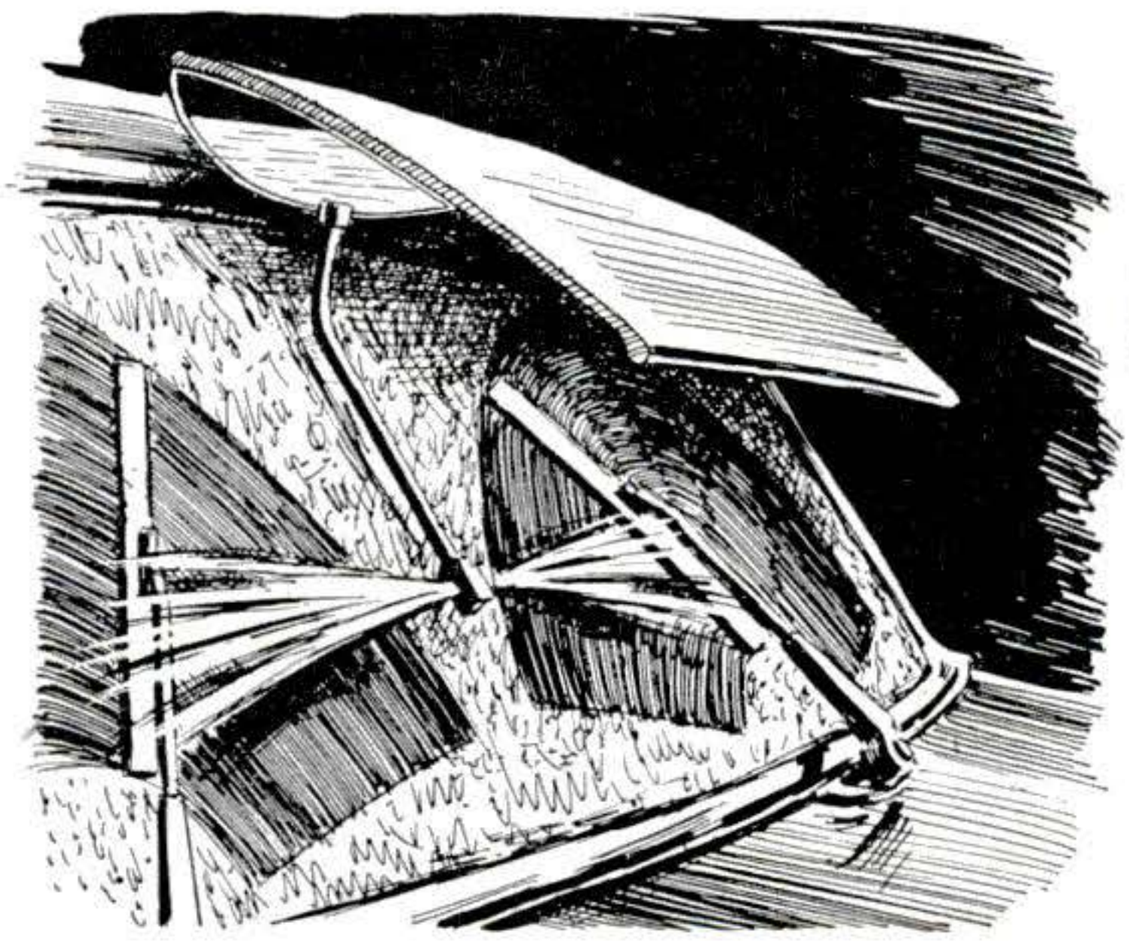
New Ideas

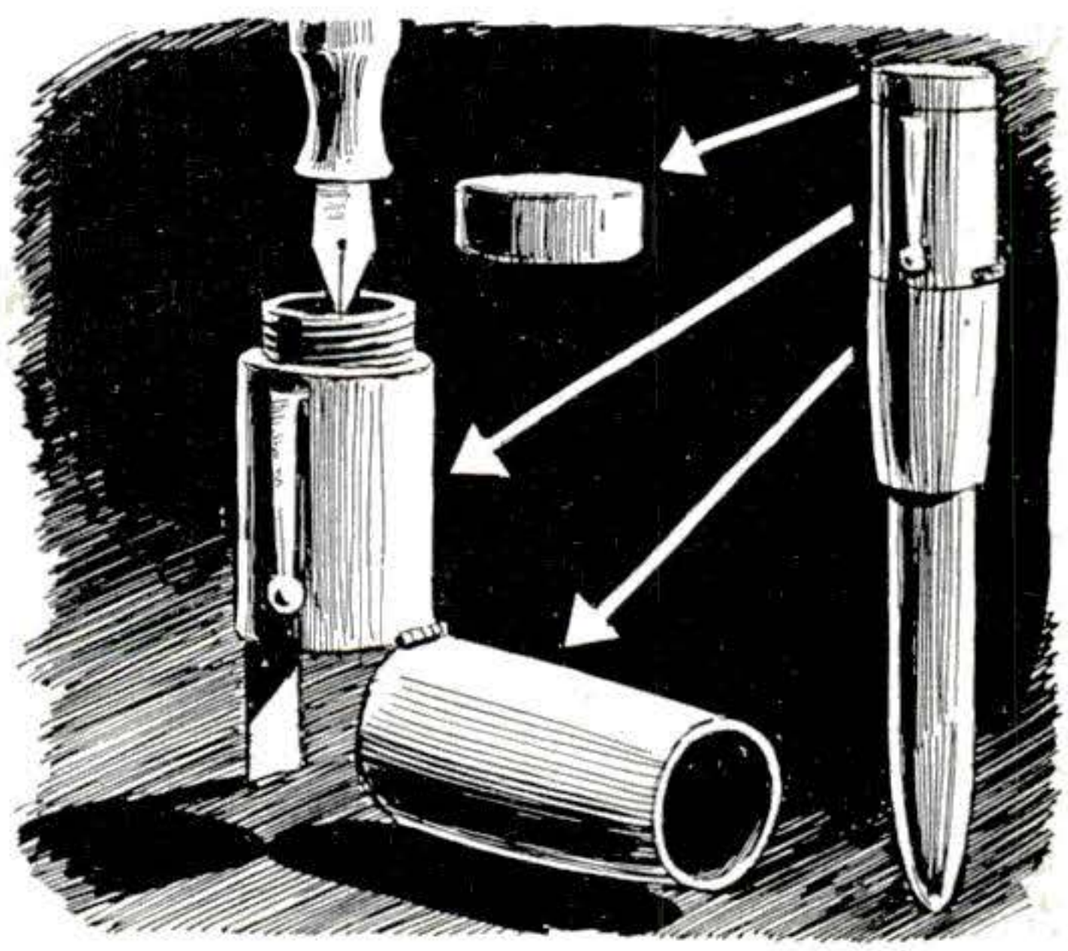
FROM THE INVENTORS



1 Suit to Cool or Warm Wearer. Air-conditioned clothing would permit people to work more comfortably and efficiently near furnaces, in laboratory ovens, refrigerators, and other hot or cold places. These airtight coveralls would be spaced off the wearer's body by porous, elastic liners so that air tubed in from a cooling or heating system could circulate freely to all parts of the garment.



2 Visor to Spray Windshield. Hooked under a sun visor, one part of this water-carrying attachment would provide a windshield-cleaning spray. A metal tank would hold the wash water. A separate, evaporation-cooled canvas sack would carry a supply of drinking water that could be piped into the car through a separate tube and valve.



3 Pen Cap to Hold Extra Ink. You wouldn't be likely to run out of ink if your pen cap held an emergency supply. The upper part of this cap would form a leakproof reservoir and would be hinged to the part that covers the point. Bent open as shown, it would hold the ink chamber upright while the pen was being refilled.

Please turn the page for more new ideas.

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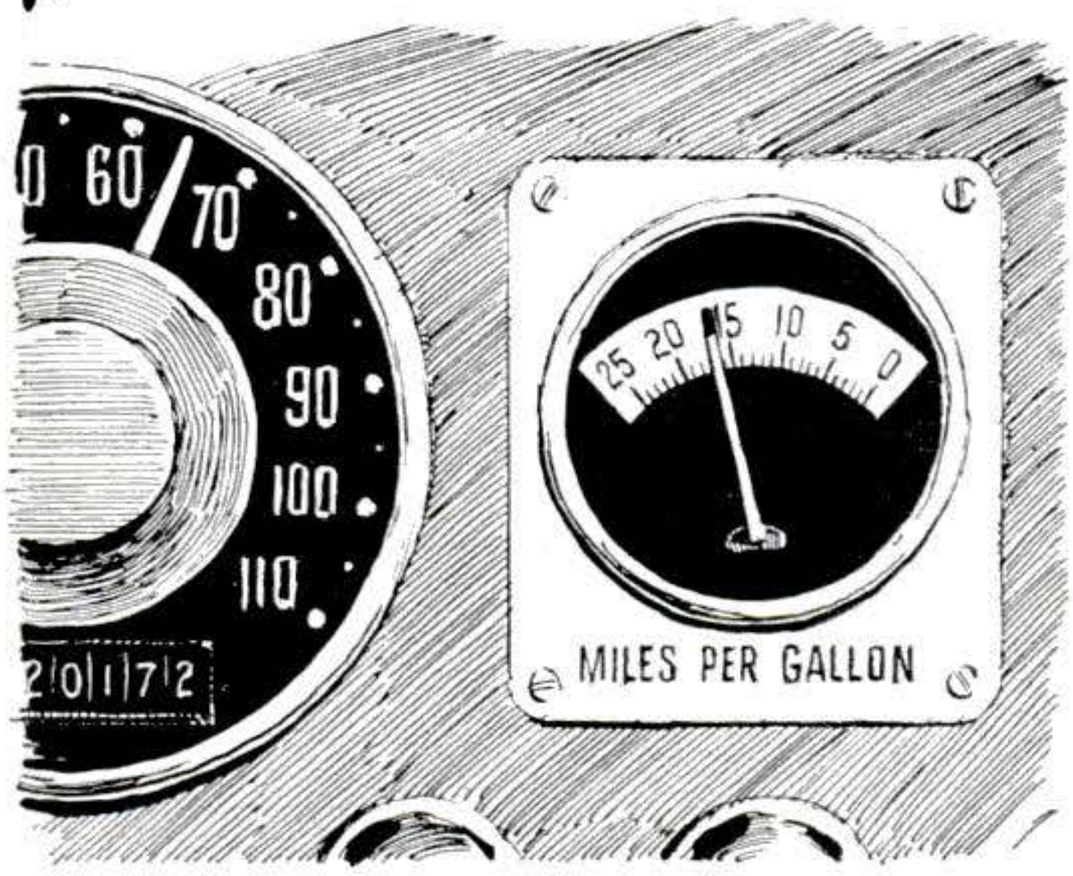
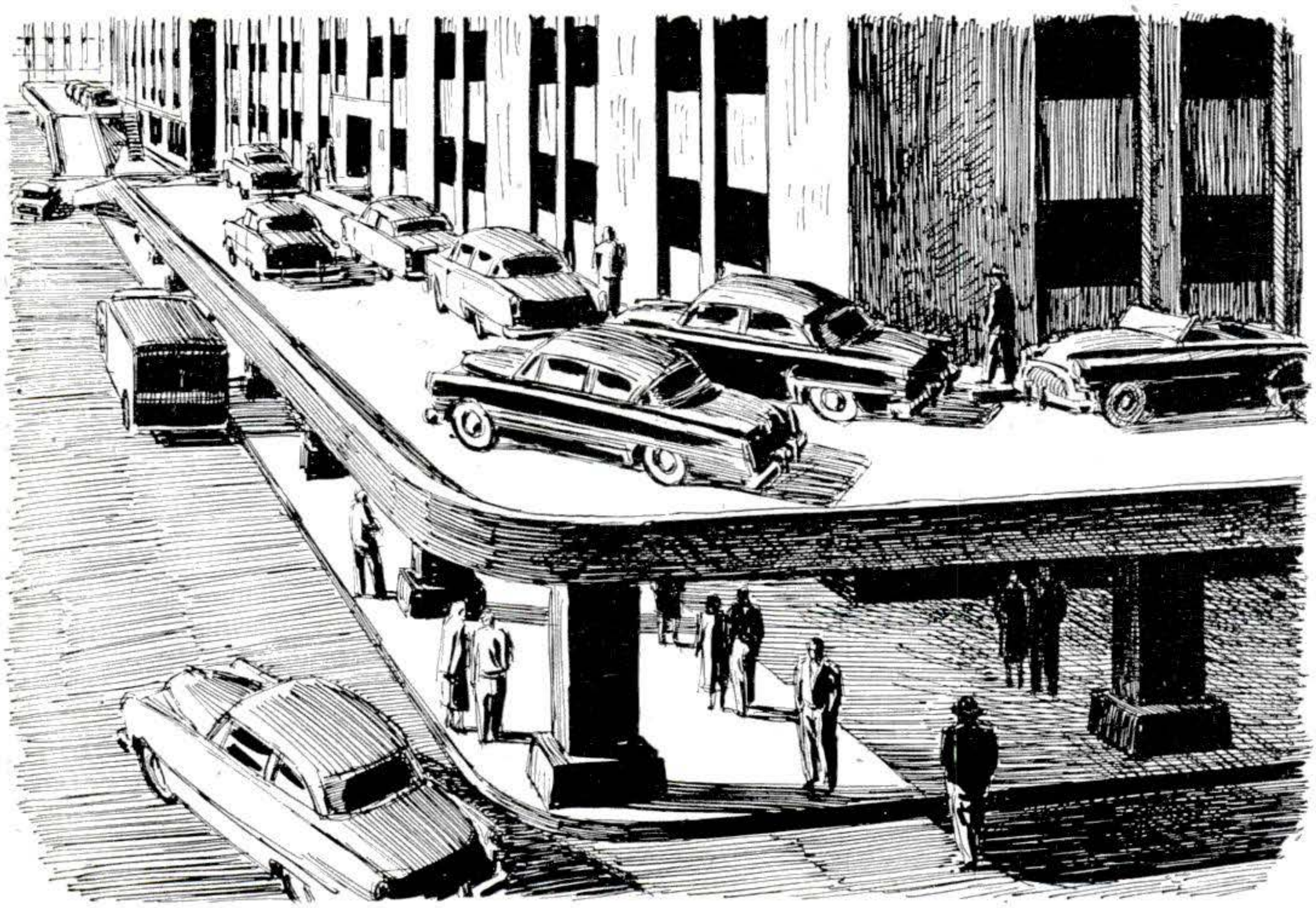
MORE New Ideas from the Inventors



4 Gauge to Show Fuel Efficiency. A direct-reading, miles-per-gallon indicator would warn a driver when wrong speed or engine sluggishness was wasting gas. This system would generate two currents, one keyed to wheel speed, the other to fuel flow. A meter circuit would integrate the two to relate gas used to distance traveled.

5 Meat Chopper to Add Spices. Hamburgers would come out of this grinder thoroughly seasoned, and with the flavoring distributed evenly through the meat. Dry or liquid spices placed in a hopper would be added to the meat at a uniform rate and mixed in with it. The cook would pick out the spices and set the hopper's rate of feed.



6 Ramps to Ease Parking Squeeze. Overhead streets, says this inventor, could provide the extra curb space needed in many business and shopping districts. He would have cities and property owners join in building two-lane elevated strips having access ramps for cars, footwalks and stairways for pedestrians. He points out that upper-level store displays and entrances would give buildings two street floors.

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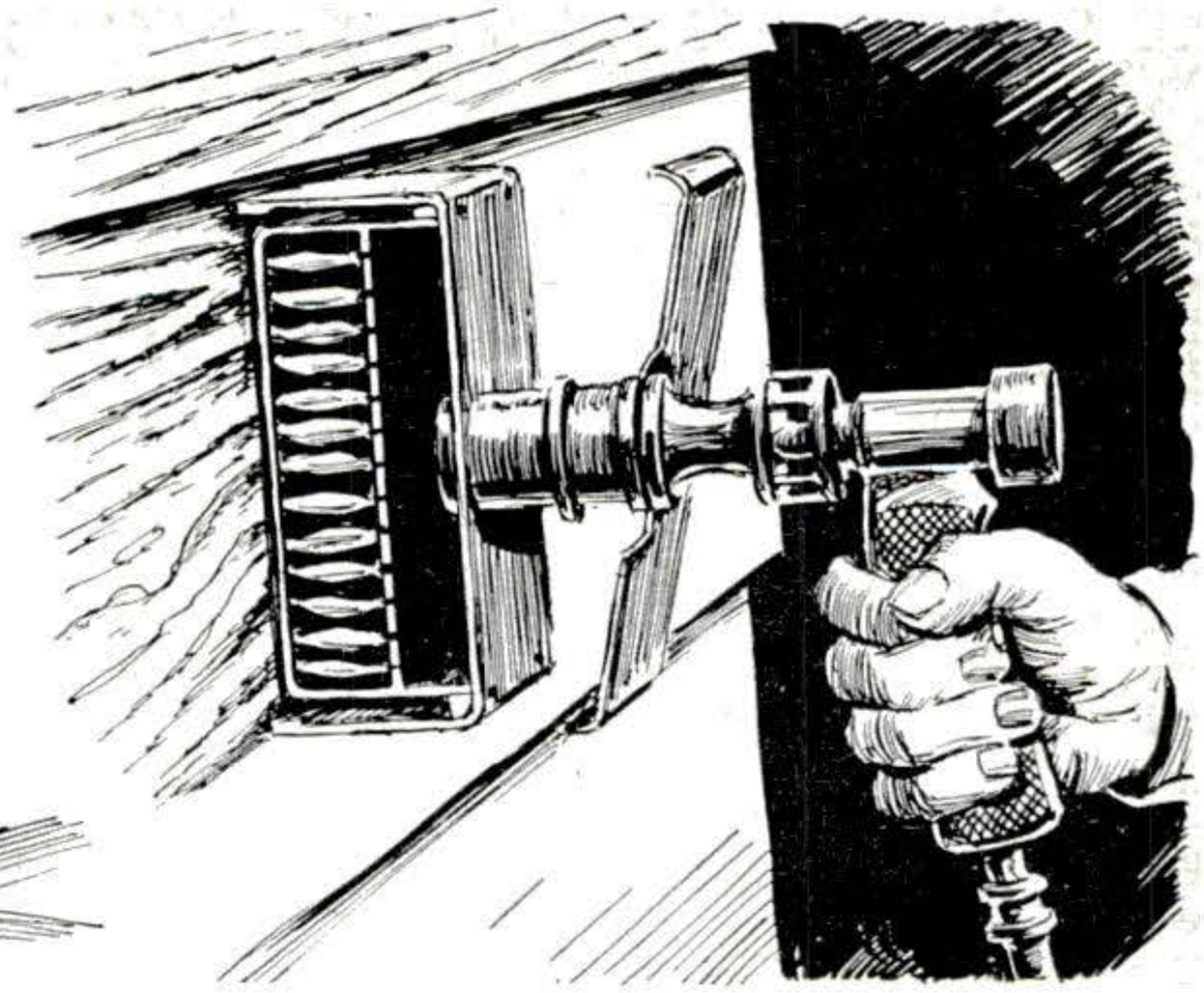
7 Ice-Type Skate to Have Wheels. You could glide the same way winter and summer if your roller skates had in-line wheels. These would behave like ice runners and allow you to cut the same figures with the same form. Wheels would be individually sprung and cushioned to make them "float" over bumps and pavement cracks.



8 "Flameless" Torch to Raise Paint. You wouldn't have to worry about scorching a wall or setting it on fire if you burned off paint with this torch. The flame, enclosed in a metal hood, would heat a sole plate. A spacer shield would keep the hot plate from touching the surface but let it come close enough to soften the old coat.

9 Cage to Guard Drive-In Teller. This glass wall would protect drive-in bankers against bad weather and motorized thieves. The teller would be completely inaccessible from the outside though he would be able to talk to customers over an intercom and shuttle cash and papers back and forth through a sliding drawer.

U. S. patents on these inventions have been granted to: 1. A. M. Klein, Brooklyn, N.Y., and J. F. Hall, Jr., Dayton, Ohio.; 2. E. E. Foster, Austin, Tex.; 3. M. Fried, Brooklyn, N.Y.; 4. T. O. Zschokke, Perris, Calif., and H. H. Chappell, Sunnymead, Calif.; 5. L.H. Balmain, Fair Oaks, Calif.; 6. H.A. Lebert, Millbrae, Calif.; 7. E. Kahlert, Santa Ana, Calif.; 8. J. Prent, Amsterdam, Netherlands; 9. E.C. Beedle, Bay Village, Ohio.

How Louisville Sluggers Are Made

Ted Williams swings his Louisville Slugger.

Behind the batter are the craftsmen who make the stick that swats the ball.

By George Laycock

PROFESSIONAL ballplayers treat their favorite bats with love and respect, handle them gently except at home plate, and frown at anyone who dares touch them. They know that it takes a lot of skill to make a good bat, just as it does to use it.

You can get a look at the batmaker's skill if you stop in at Hillerich and Bradsby in Louisville, Kentucky, home of the best-known bat in baseball, the famous Louisville Slugger. Nearly all of the players in both the major and minor leagues swing bats from this factory. They know that no place else in the world is there more know-how about making baseball bats.

From this plant comes about half of the country's estimated annual production of six million bats, almost equally divided between soft- and hard-ball bats. There are about 200 styles and sizes.

The best baseball bats get their start on the wooded mountain slopes of Penn-

1 CHOICE WHITE ASH makes best bats. Cut to 40-inch lengths, small logs are split into wedges and turned into "rounds," while big ones are sawed into bat-size squares.

2 BILLETS, or rounds, are examined and graded by a timber inspector. He determines the size bat each will make and marks the handle end. Billets are then cured.

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Several million bats-in-the-rough are stacked in the big seasoning yard for 12 to 18 months.

3 CURED BILLET goes into a turning lathe. Within 15 seconds, a set of 49 razor-sharp knives has roughed out the timber into the general shape of a baseball bat.

4 ROUGH-OUTS are carefully weighed and each piece is graded according to the model for which it is best suited. Inspection is continuous along the bat assembly line.

5 KNIVES of this final turning lathe are adjusted to cut and form rough-outs to the exact length, diameter and shape of the original handmade Yogi Berra bat.

6 SANDING is important. Here a rough job is being done by a powered sander belt. During production homestretch, each bat gets a light hand-rubbing with steel wool.

sylvania and New York. Most of them are made from white ash, which has the required tensile strength and resiliency and is lighter than hickory, its nearest competitor. Timber buyers who locate ash for bats look for trees with straight, even grain.

From the cream of this ash crop come the Louisville Sluggers, each branded with the autograph of a major-league player. A player's name on one of these bats, even if they're turned out by the thousands, means that the bat is patterned after one that the player has used. The company started collecting autographs back in 1905, when Honus Wagner offered them the use of his name.

The First Slugger Is Made

A separate department hand-turns individual bats to order for professional players. In fact, that's how Hillerich and Bradsby started making bats back in 1884. In those days the company concentrated on butter churns and fancy porch railings. J. Fred Hillerich didn't want anything to do with such fads as making ball bats.

But Bud Hillerich, his son, was a red-hot baseball fan. That was why he spent a large part of one evening in 1884 turning out a bat for Pete Browning, a Louisville star of the day. Browning had broken his favorite bat. Bud Hillerich volunteered to pull him out of the hole, and the following day, with a firm grip on his new bat, Browning racked up three safe hits in three times up.

Bats are still turned out for professionals in much the same manner. Here's what happens if the Cubs wire Louisville for a half-dozen bats for Hank Sauer. First, the original of Sauer's personal model is taken from the archives, a locked, fireproof room stacked with hundreds of bats used by professional players of today and yesterday. A skilled judge of bat timber takes the model to the timber stacks and selects just the piece which, when turned to an exact duplication of Sauer's bat, will match it in weight to within a fraction of an ounce.

In the turning shop, the model is put in a parallel rack on the lathe into which the selected billet is locked. The new bat is turned with hand chisels until it is an exact duplicate of the original.

Bat craftsmen recall some peculiar demands made on them by players. Babe Ruth always wanted his bats to have tiny pin knots around the "sweet spot" where

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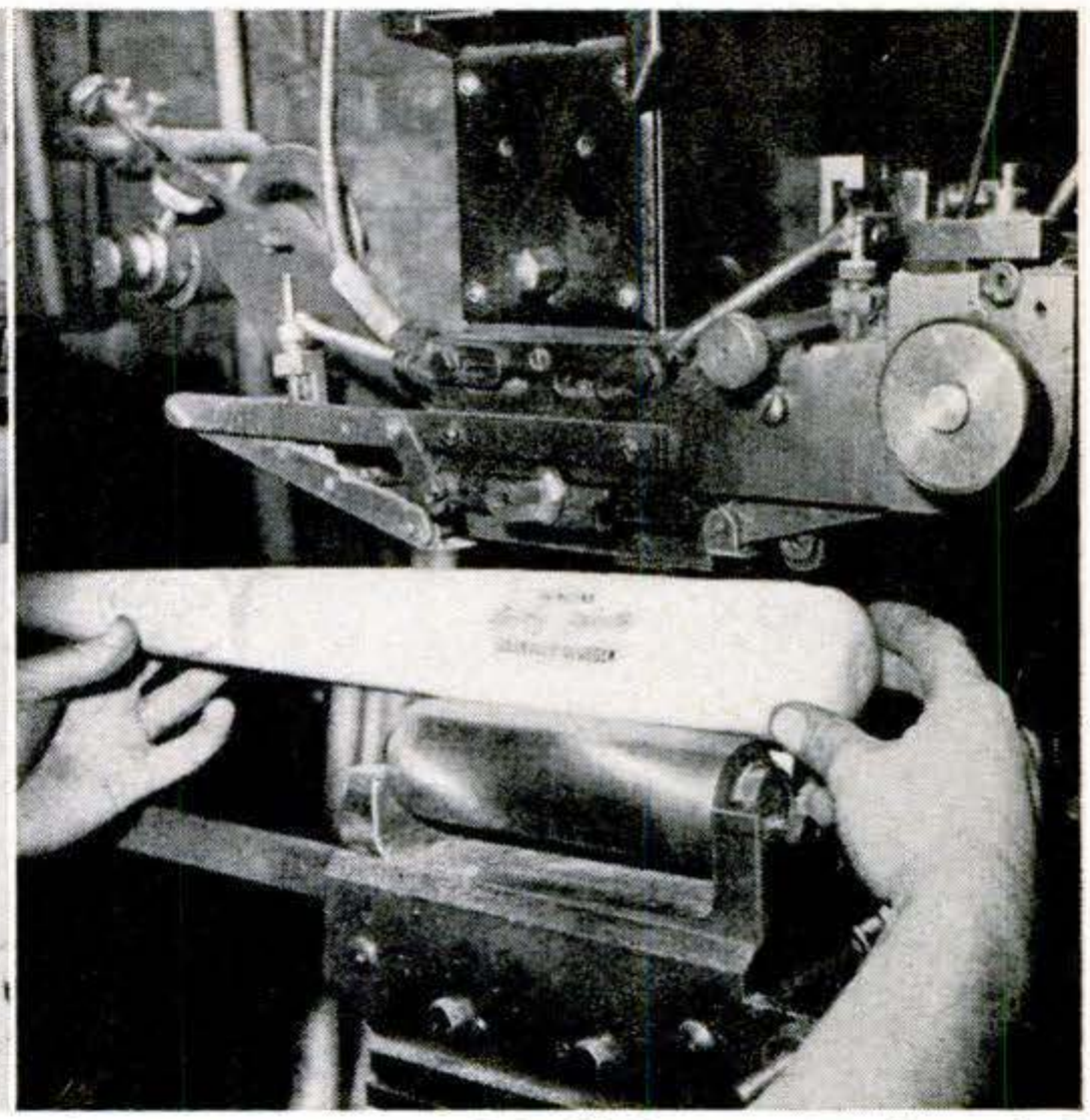
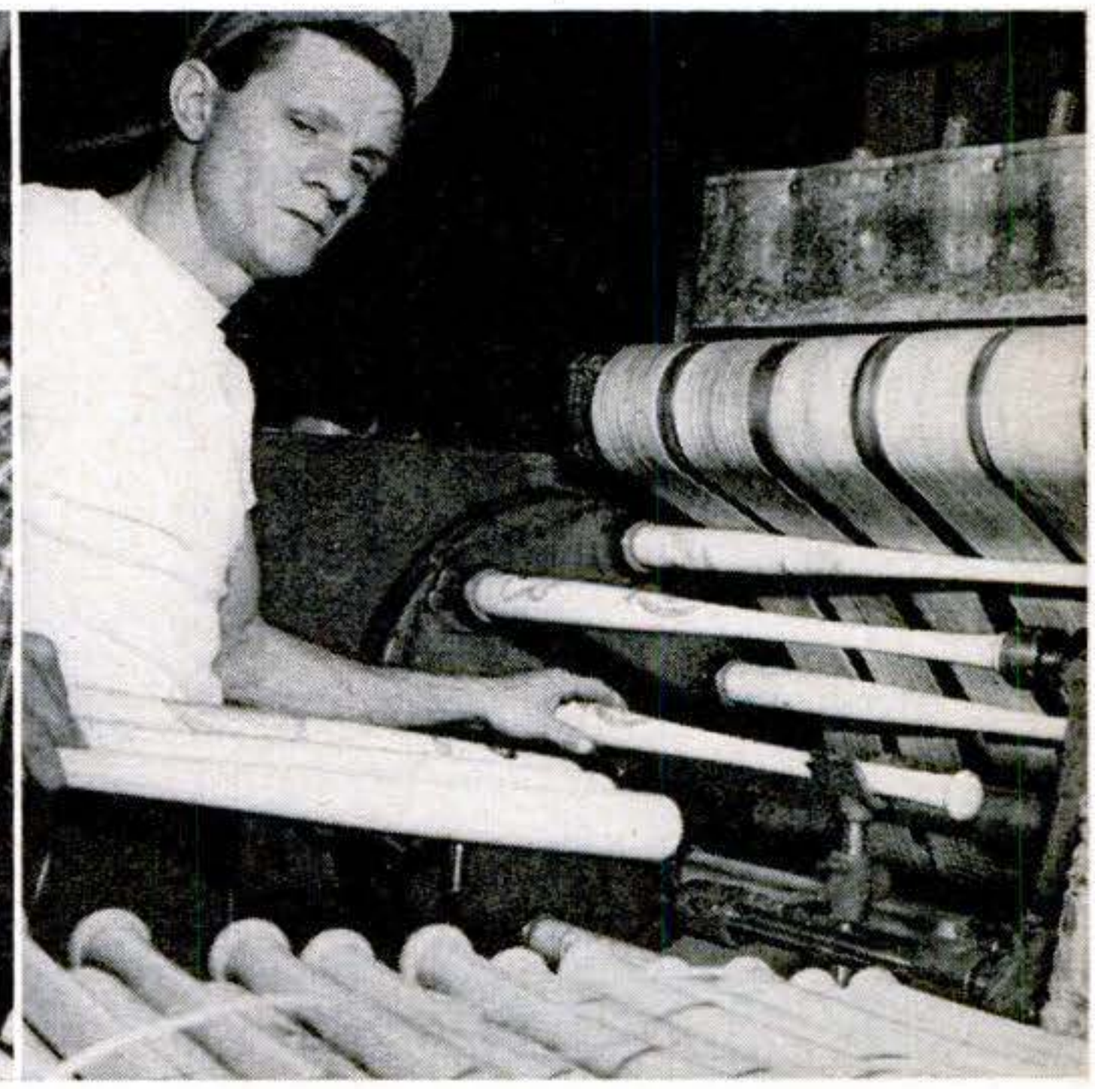
7 INSPECTION again. Under daylight lamps, all bats must pass the critical eyes of highly skilled men. If there are no newly exposed defects, they go to final automatic sander.



8 AUTOGRAPHS of ballplayers are branded on commercial copies of their original Slugger models. Most big-league players are represented. Above is Mickey Mantle model.

9 BATS are given either a natural-grain finish or stained in a choice of colors. Here a girl dips bats into a clear-lacquer vat and then hangs them up to drip and dry.



10 FINAL TREATMENT on waxing and buffing machine puts glass-hard finish on the bats. They are now ready for shipment to little-leaguers and sandlotters everywhere.

the ball hits. He ordered more bats than any other player, although he seldom broke one. Instead, he passed them out to admirers. Eddie Collins demanded bats with a streak of red heartwood in them. Hugh Duffy always bounced the rough billets on the concrete floor until he found one with just the right "ring."

"When you're choosing a bat," say the Louisville Slugger makers, "get one just long enough to cover the plate from your proper batting place. This lets you reach all pitches in the strike zone."

Last year, when the subject of laminated bats came up, the bat experts in Louisville had already put years of research into them. But they think the laminated bat hasn't yet been made that can hold its own against the solid-wood club at home plate. END

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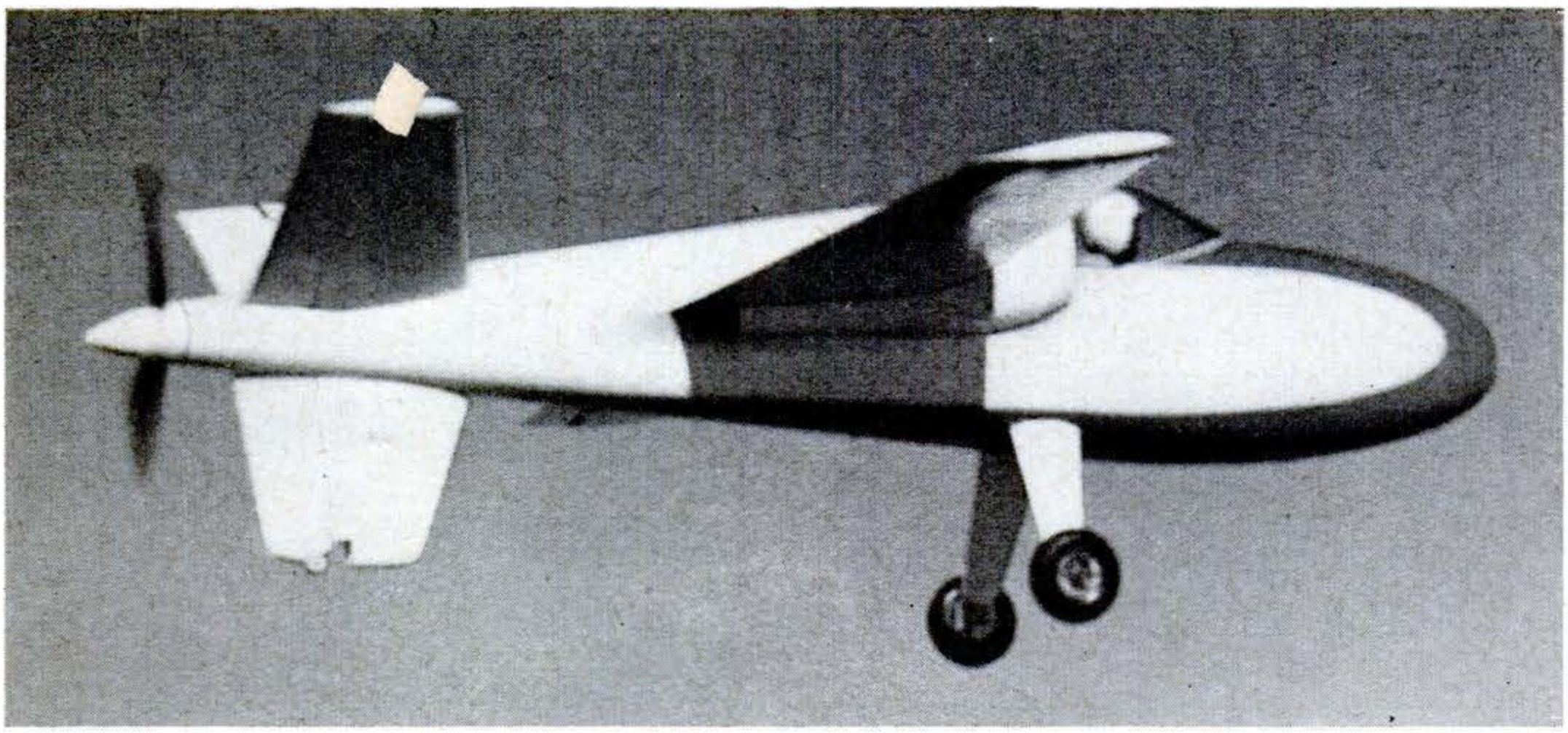
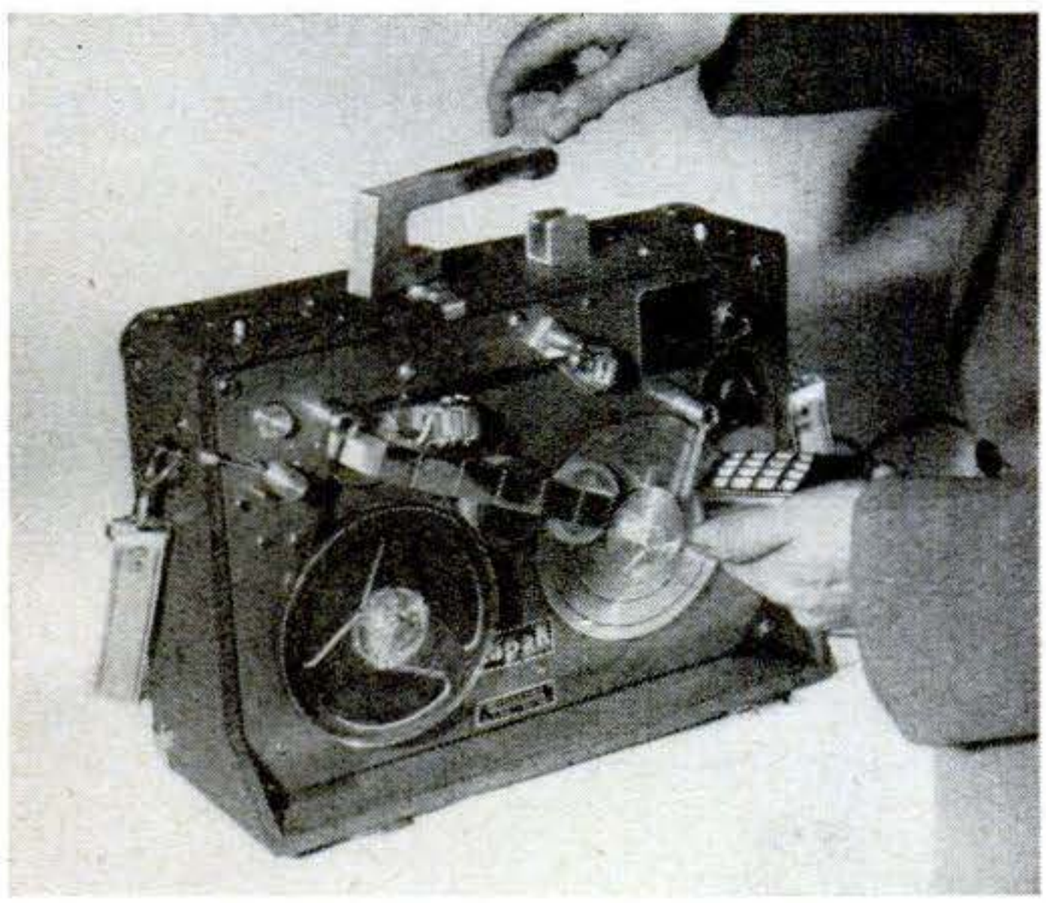


Prop in Tail Pushes Sports Plane 200 Miles an Hour

THIS little prop-in-tail experimental plane, called Sierra Sal, hits a top speed of 200 miles an hour. An 80-hp. Continental engine buried in the fuselage aft of the pilot spins the 57-inch plastic prop. The owner-designers, aircraft engineers Walt Fellers and Ron Beattie, say that the V tail prevents turbulence, as only one prop blade at a time is in a disturbed area.

The rudder, set below the fuselage to protect the prop (right), carries the tail wheel. Built to Goodyear Trophy Race specs, the 18-foot-long plane with 20-foot span weighs only 600 pounds.



Now—the Walkie-Recorder

A NEW spot-news recorder for broadcasters is run by a spring-wound motor, cranked with the carrying handle. Recorder, mike, monitor phone and a spare tape fit into the case. It can be shut and used while slung over the shoulder. Broadcast Equipment Specialties Corp., 135-01 Liberty Ave., Richmond Hill 19, N. Y., makes it.

Car Ferry Rides the Rails

THE cars and motorcycles above are crossing the North Sea, but not under their own power. They are being ferried across on a freight train. The tracks are laid down on an earthwork dam, the only connecting link between the Isle of Sylt and the German shore. The roadbed, called the Dam of Hindenburg, stretches more than 24 miles.

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An Atomic Locomotive Could Be Built

Here's how a noted designer of reactors would construct it, provide shielding against the radioactivity of its power plant, refuel it—and revolutionize railroading.

A MIGHTY 7,000-hp. engine called the X-12, first atom-powered locomotive ever designed, is technically feasible. Within two years it could be hauling a high-speed Atomic Limited across country. Eleven pounds of uranium would fuel it for a year.

These are highlights of an atomic-locomotive study by a University of Utah group under the leadership of Dr. Lyle B. Borst, professor of physics and a former designer of nuclear reactors for the Atomic Energy Commission. Five railroads and nine industrial firms cooperated in the project, a private one having no connection with the AEC. Its conclusions are told in a remarkable 54-page report entitled, *An Atomic Locomotive: A Feasibility Study.*

Uranium Cost Is Secret

Because the study used only nonsecret data, nothing about it is censorable, and so the report is able to give the most revealing picture to date of the mechanical details of applying atomic power to vehicular propulsion.

For the same reason, the report necessarily lacks one secret figure—the exact cost of pure uranium-235 fuel—that is all-important in determining whether atomic choo-choos are the coming thing. But from what he considers a reasonable estimate, Dr. Borst predicts that "the proposed locomotive will compete successfully with diesel power under favorable circumstances."

Primarily, the object of the study was to learn whether an atomic locomotive could be built at all—a possibility doubted by many experts. The researchers believe they have a workable design.

Outwardly resembling a streamlined diesel, the projected "atom burner" is 160 feet long. It has two sections. The forward one, a power unit devoid of a smokestack, contains the nuclear reactor and its massive shielding. It also houses a steam turbine, electric generators, and electric traction motors to apply power to the 12 driving axles. In short, it is a turboelectric locomotive, whose steam boiler is built into and around the nuclear reactor itself.

The trailing section carries radiators equal to more than 1,000 automobile radiators, and its roof is studded with whirling fans. Its purpose is to cool the water circulated to it from the condenser of the steam turbine, and thus transfer excess heat from the atomic power plant to the surrounding atmosphere.

Fuel Will Be Liquid

Designers of this 360-ton rail giant visualize it at the head of a crack passenger train or a fast freight. The big advantage over conventional types that they

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predict for an atomic locomotive—lower fuel cost—will show up best in hauling heavy loads at high speeds with short turnarounds.

The heart of the X-12, its six-sided nuclear reactor, is three feet square and one foot thick. It can be so small because it burns uranium of the concentrated U-235 variety. Its fuel will be in liquid form—a solution of uranyl sulfate, a yellow or yellow-green salt of uranium, in water.

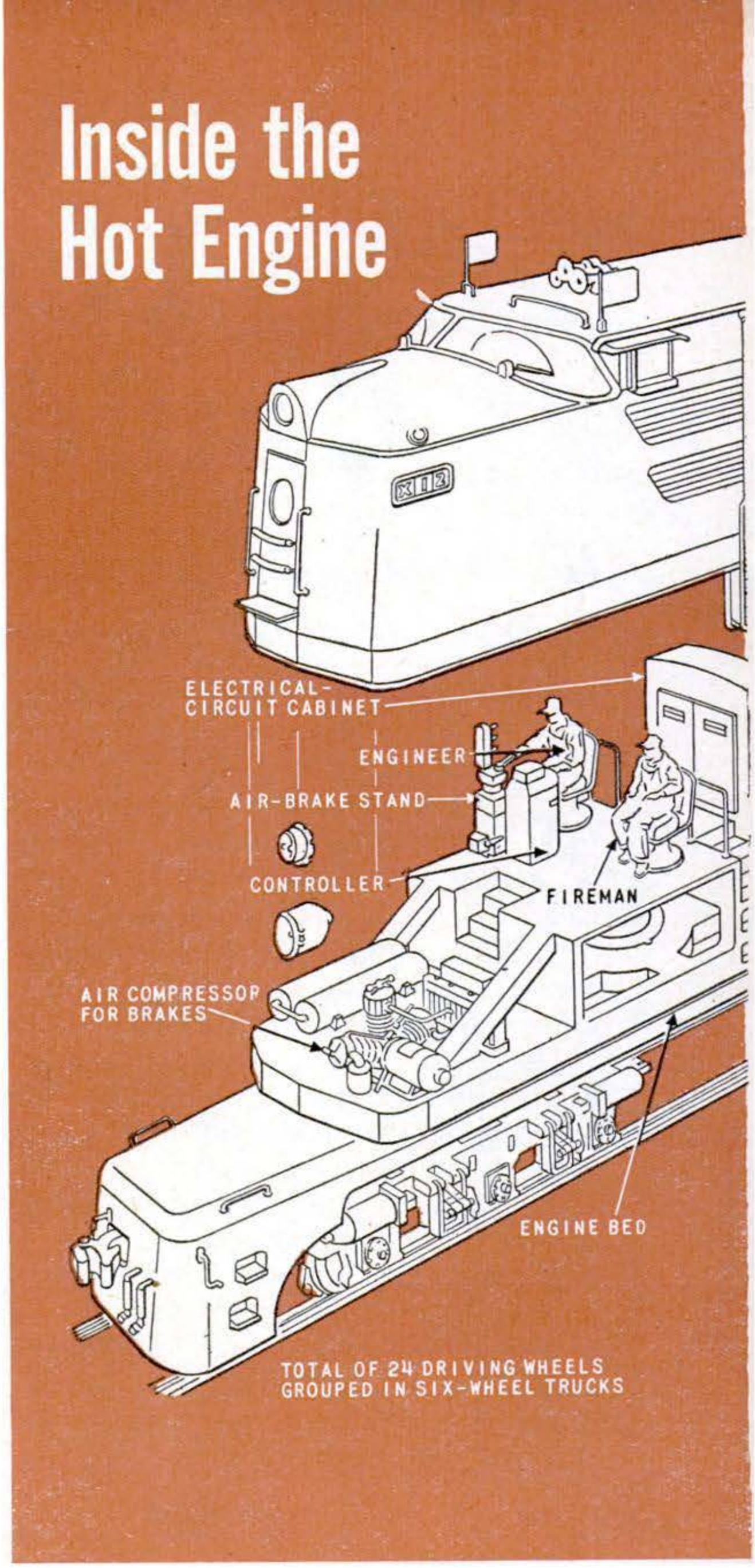
When control rods are withdrawn from this liquid-fuel "soup," a chain reaction takes place. Its heat vaporizes pure water in a surrounding jacket, the boiler that supplies steam to the locomotive's turbine. The pure water circulates not only through the jacket, but also in 10,000 pencil-thin stainless-steel tubes extending through the soup in the reactor, to pick up heat more readily.

Once steam is up and the atom burner is rolling, its engineer's task is a simple one. Principal instruments in his cab will be a conventional steam-pressure gauge and ammeter, and he will use a standard controller for a throttle.

Reactor Is "Infinite" Power Source

One outstanding feature of an atomic express, noticeable to engineer and passengers alike, will be its rapid pickup. The X-12 could be designed to accelerate a 5,000-ton train from a standing start to 60 m.p.h. in three minutes and 32 seconds. The reason is that, while its normal power is 7,000 hp., its reactor actually is an "infinite" or unlimited power source. So the engine could have an "overload capacity" of, say, up to 12,000 hp. for short periods.

How can the intense radioactivity of the X-12's power plant be kept from endangering the train crew, and passengers and bystanders on station platforms, too? Here was the stumbling block for would-be designers of A-locomotives, concluded one survey of atomic-power possibilities that was published by Princeton University in 1950. Its authors reported that stopping the deadly rays would take at least 100 tons of shielding, seemingly too much bulk to fit within the clearance limits of a locomotive.



But the X-12's designers have succeeded in shoehorning 200 tons of shielding, twice this amount, within the allowable limit of a locomotive's breadth. To do it, they use such unconventional machinery as "dachshund" generators with rotors eight feet long, which can be squeezed into spaces only two feet wide and deliver the needed power.

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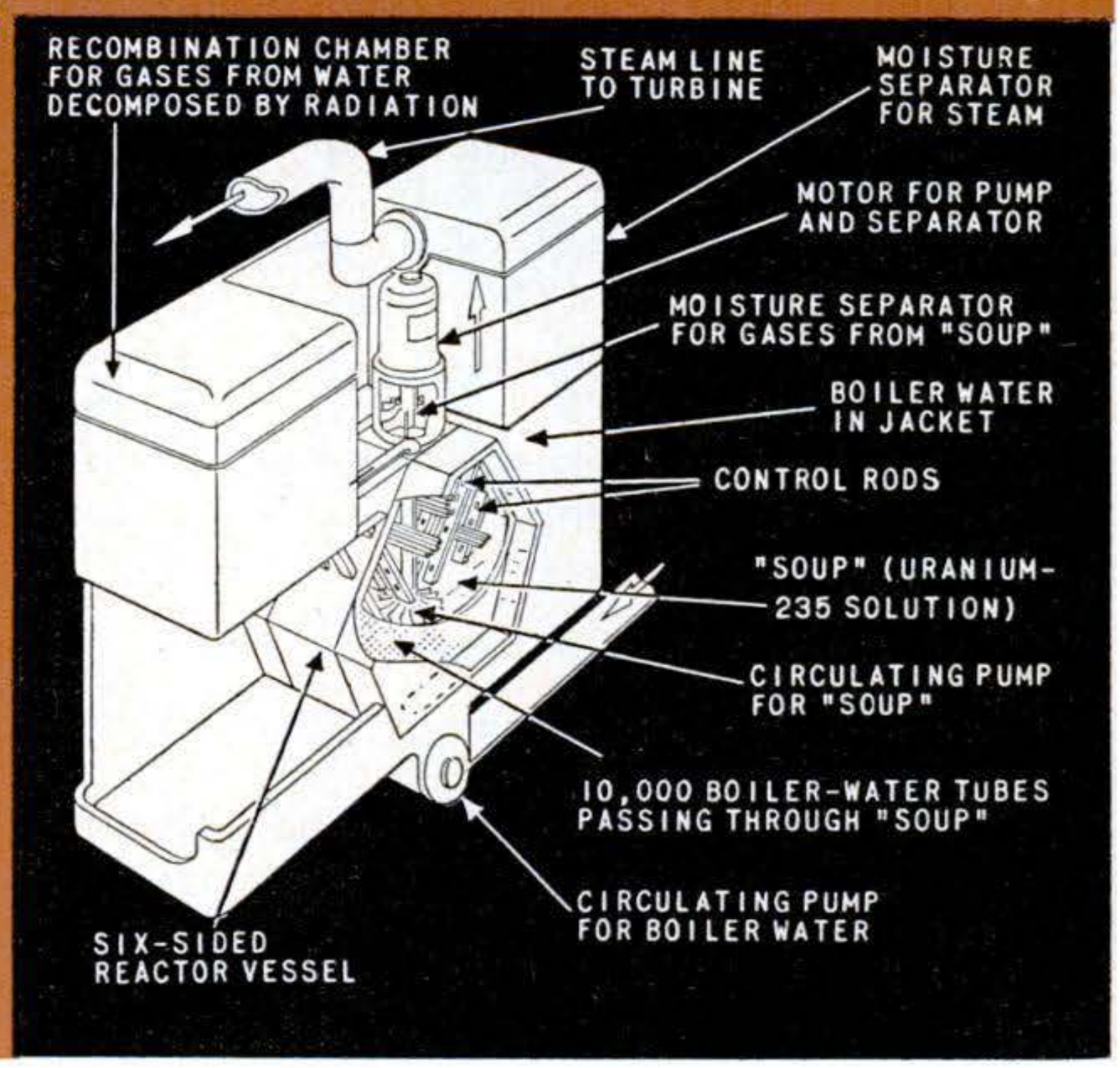
FANS BLOWING AIR OVER RADIATORS TO COOL CONDENSER WATER
REACTOR COMPARTMENT
GEARS TO TRANSMIT TURBINE'S POWER TO GENERATORS
CONDENSER
TRAILING TRUCK, NOT POWERED
RADIATORS IN TRAILER EQUIVALENT TO MORE THAN 1,000 AUTOMOBILE RADIATORS
WATER LINES BETWEEN CONDENSER AND RADIATORS
PIVOTED ENGINE BED SHARED BY TWO LOCOMOTIVE SECTIONS
STEAM TURBINE
LAMINATED SHIELDING
TWO OF FOUR GENERATORS
NUCLEAR REACTOR
600-HP. TRACTION MOTORS GEARED TO DRIVING AXLES
BRIDGE TRUSS SUPPORTING 200-TON WEIGHT OF SHIELDING



Thus the reactor can nestle within a massive block of shielding four feet thick, measuring 10 by 15 by 15 feet over-all. It will consist of alternate layers of steel, to confine gamma rays; and of a neutron-stopping "hydrogenous material," which could be water, paraffin or plastic.

How can safeguards be provided against the new peril of radioactivity on the loose, in case of a wreck? First, the successive steel layers of the massive shielding will keep a collision from spattering the wreckage with radioactive soup; even if some layers were ruptured, others would remain intact. Second, a crash would automatically shut down the reactor. Control rods are mounted at 60 degrees from the horizontal, and each mounting includes a shear pin, or weak link. An impact from any direction exceeding a force of 1/5 of a "G" will snap the shear pins, and momentum and grav-

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TYPE OF LOCOMOTIVE	WEIGHT	LENGTH	DRIVING WHEELS	HORSEPOWER	FUEL CAPACITY
STEAM (UNION PACIFIC'S "BIG BOY")	597 TONS	130 FEET	16	6,670	COAL: 28 TONS WATER: 25,000 GAL.
ELECTRIC (VIRGINIAN'S MOTOR-GENERATOR TYPE)	500 TONS	150 FEET	32	6,800	———
FOUR-UNIT DIESEL (GENERAL MOTORS' F-7)	486 TONS	201 FEET	32	6,000	FUEL OIL: 4,800 GAL.
GAS TURBINE-ELECTRIC (UNION PACIFIC)	250 TONS	84 FEET	16	4,500	FUEL OIL: 7,000 GAL.
ATOMIC (X-12)	360 TONS	160 FEET	24	7,200	URANYL SULFATE SOLUTION: 64 GAL. (CONTAINING APPROX. 20 LB. U 235)

ity will do the rest. From withdrawn position, the control rods will be driven or will fall back into the center of the reactor, stopping the chain reaction.

When the locomotive is running at full power, the nuclear reactor will develop heat at the rate of 30,000 kilowatts, and the soup temperature will be 455 degrees F. While this temperature rapidly vaporizes the boiler water in the tubes, the uranium-solution soup itself will not boil, because of the pressure of 650 pounds to the square inch under which it is confined in its vessel.

But provision must be made for another thing that happens to it, and a strange one.

Water Must Be Reconstituted

Under the intense radiation of the reactor, the water of the soup breaks down into hydrogen and oxygen gas—at a rapid enough rate for 10 percent of the 64 gallons of soup to be lost in only 13 minutes. To offset this and maintain the volume of soup intact, the hydrogen and oxygen gases are led to a novel auxiliary device called a recombination chamber. Here a chemical catalyst reunites them, to form water again, and the water is returned to the soup vessel.

In all, then, there are three separate water-circulating systems: for the reactor's soup; for the boiler water and the steam it makes, which is condensed and piped back to the boiler after driving the turbine; and for the cooling water of the steam turbine's condenser. Since each is a closed system and returns the water to its original source, the water consumption of the X-12 is negligible.

Refueling will be a major operation requiring two to three days, and to be performed only by atomic experts skilled in handling "hot" materials with remote-control implements. It must be done three to six times yearly. While only 10 percent of the uranium may have been consumed in the interval, enough atomic "ashes" or fission products will have accumulated to hinder the chain reaction. So the soup must be drained from the reactor, purified in a chemical plant and replaced, together with enough fresh fuel to make up the original amount. As the designers foresee, this will call for "elaborate and costly facilities." At first, A-locomotives could best be refueled at special "atomic-fueling stations" established and operated for the purpose by the AEC. Eventually, the railroads might undertake the job.

Maintenance Is "Designed Out"

Maintenance, too, will be an unprecedented problem. Inevitably some radioactivity will contaminate the steam turbine—and keeping a "hot" turbine in repair hardly seems an appealing task. But unlike a reciprocating diesel engine, a rotating turbine is a balanced machine and requires comparatively little maintenance.

As for a nuclear reactor, maintenance work must be "designed out" at the

[Continued on page 276]

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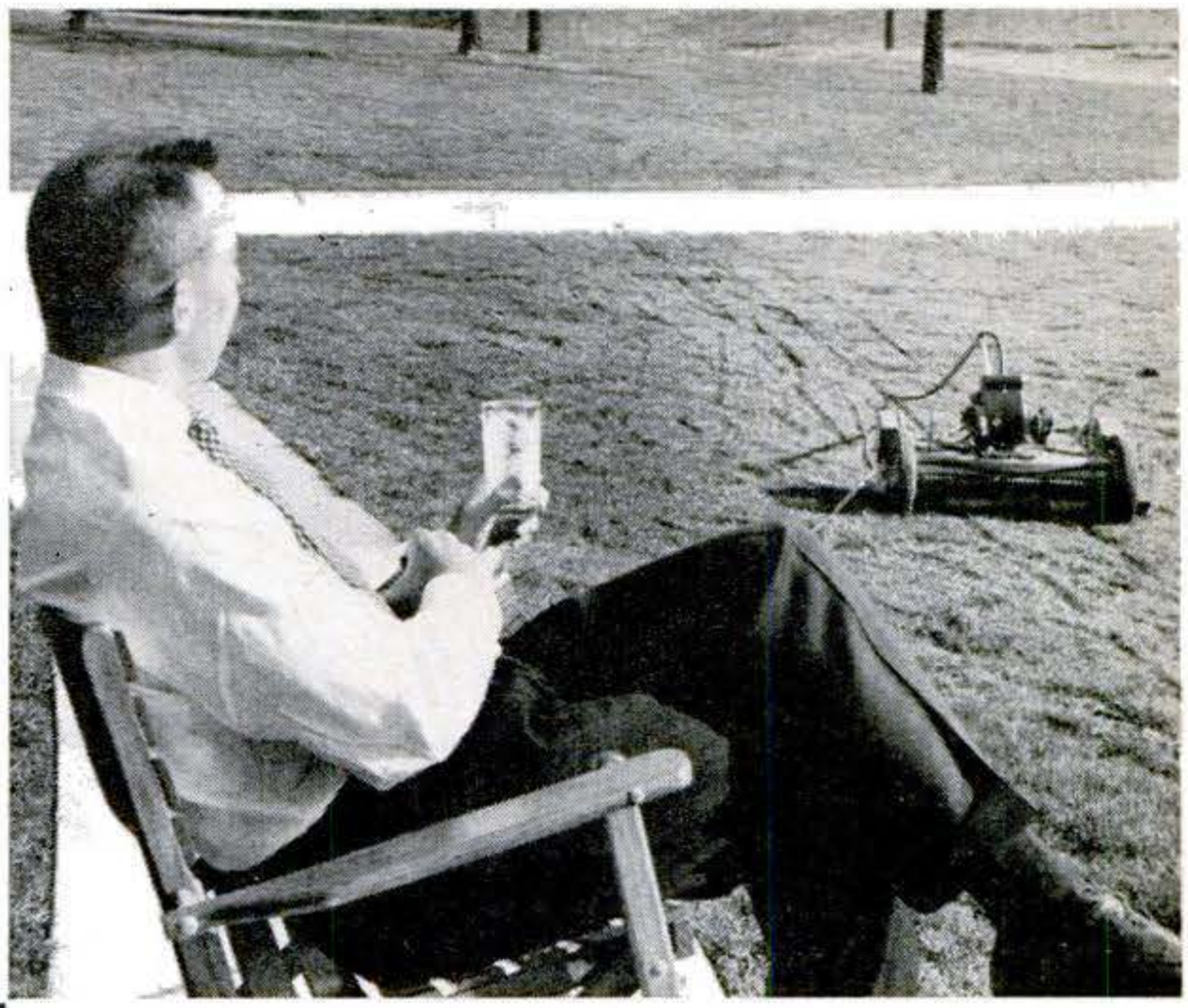
Electronic Lawn Mower Cuts the Grass While Its Operator Relaxes

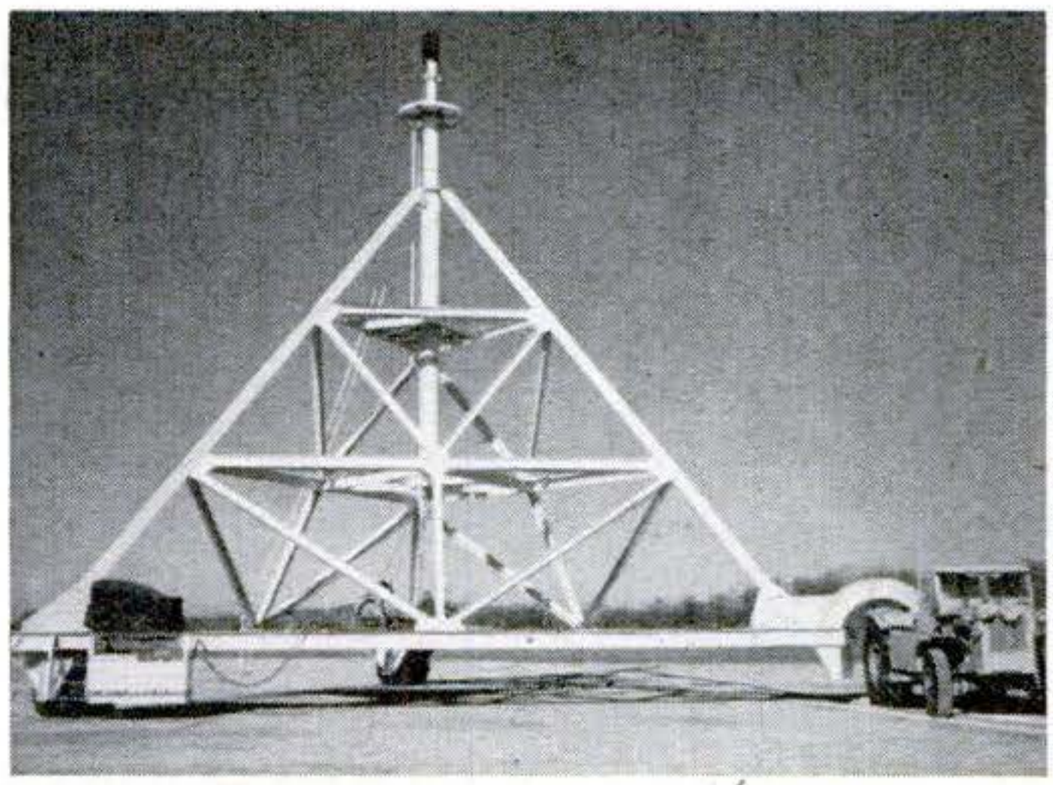
"HMM! THAT LAWN MOWER is doing quite a neat job," muses the comfortable armchair workman at right. His exertion in cutting the grass is limited to working simple controls on a little black box in his lap and managing not to spill his drink. The girl below is pushing a light dolly for trundling the 250-pound mower uphill or over rough ground.



PUSH-BUTTON lawn mowing is here. You can now lounge in the shade while a robot grass cutter does all the work. It will cost you a few dollars more than the kind of power mower that you have to follow around, but then, think of the shoe leather you'll save.

All that the Homko Robot demands of you is that you stay within 40 feet of it (the length of its cable) and occasionally flick a switch. It is a 20-inch, reel-type, electric lawn mower with a ⅓-hp. motor and two remote electronic controls. One starts, stops and reverses the Robot; the other turns it to the left or right. An alert operator can turn it in a tight circle.

The mower, made by Western Tool & Stamping Co., Des Moines, costs about $180.



Tractor Tows Blimp Anchor

EASIER and faster hauling of blimps on the ground is made possible by a new gooseneck drawbar assembly at one corner of the traditionally triangular mobile mooring mast. The Goodyear Aircraft Corp. and the Navy worked it out together.

NATO Armies Agree on a Rifle

A BRITISH infantryman is here demonstrating the 9-pound 3-ounce Belgian rifle recently chosen as a common weapon for the NATO armies. It is a 30-caliber gas-operated weapon capable of fully automatic fire. The barrel is 21 inches long.

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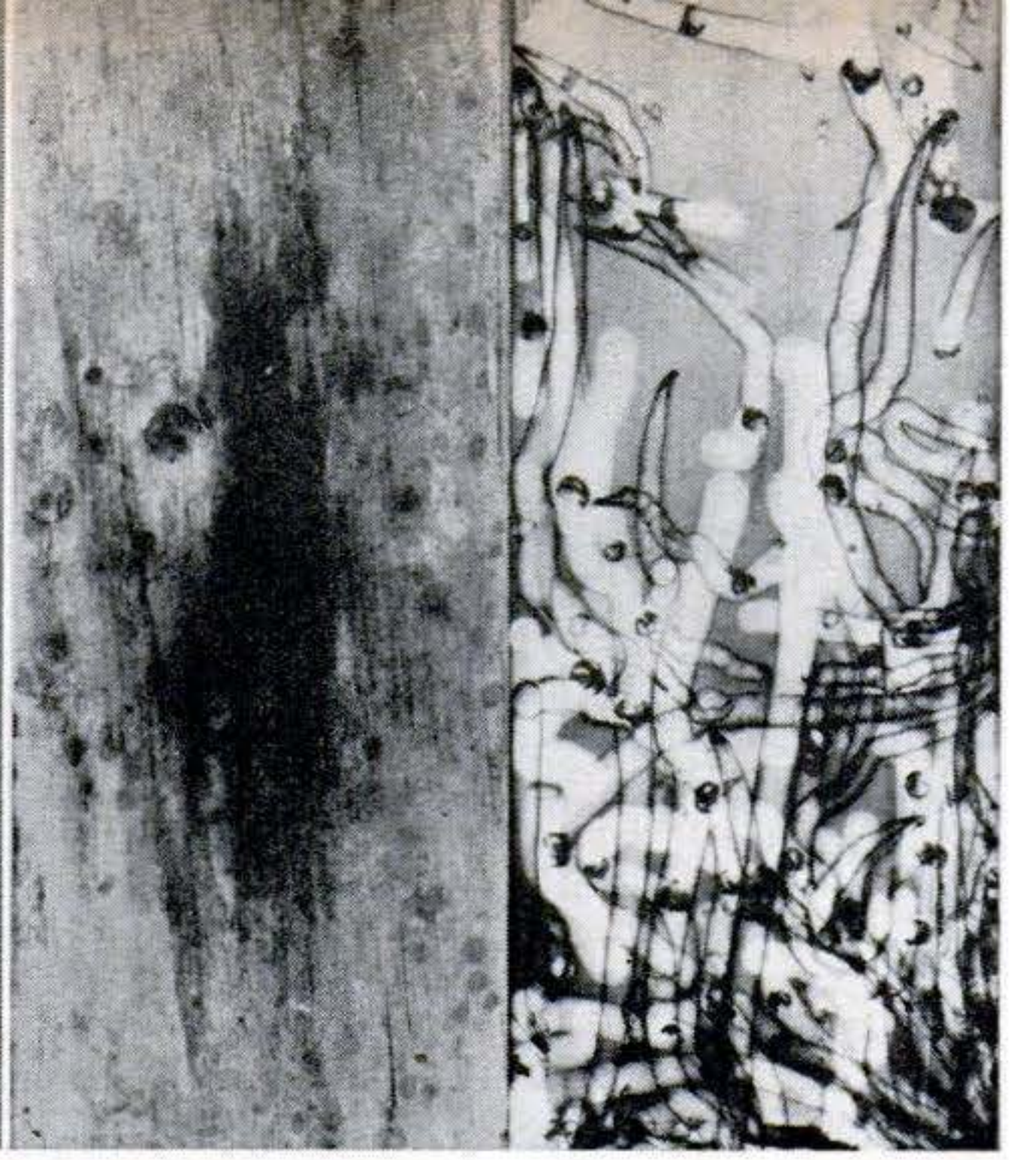
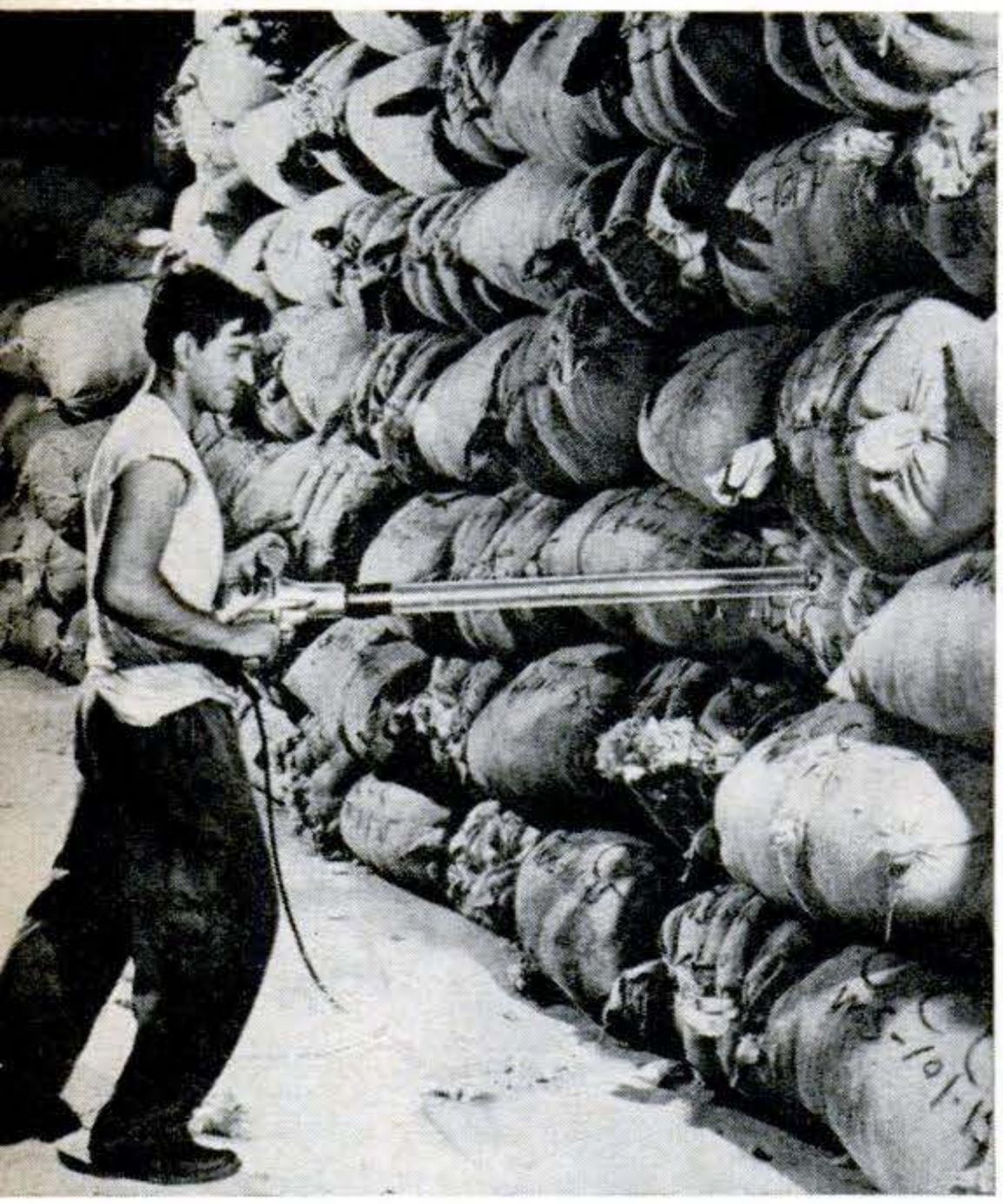


Radioactive Detective Puts an Eye on Hungry Shipworms

SHIPWORMS infesting dock pilings can't hide from the eye of the underwater camera at left above. To peer inside the wood, a metal sphere containing a pinhead of radioactive iridium is set on one side of a piling with a loaded waterproof film holder opposite it. When an aperture in the sphere is opened, rays passing through the wood make an image on the film. Above, piling is outwardly sturdy, but the radiograph taken with the Battelle Memorial Institute camera shows borers at work inside.



Portable Drill Samples Wool

TO TAKE samples of wool stacked in a government warehouse, this workman uses a long, tubular plastic bit on a Black & Decker drill to draw cores from random bags. The technique was devised by the Department of Agriculture.

Movie Helps Train Marksmen

THIS target-practice setup worked out by a former German officer lets riflemen trade shots with soldiers on sound film. The projector stops when a hit is made and a light behind the screen shows how much damage was inflicted on the "enemy."

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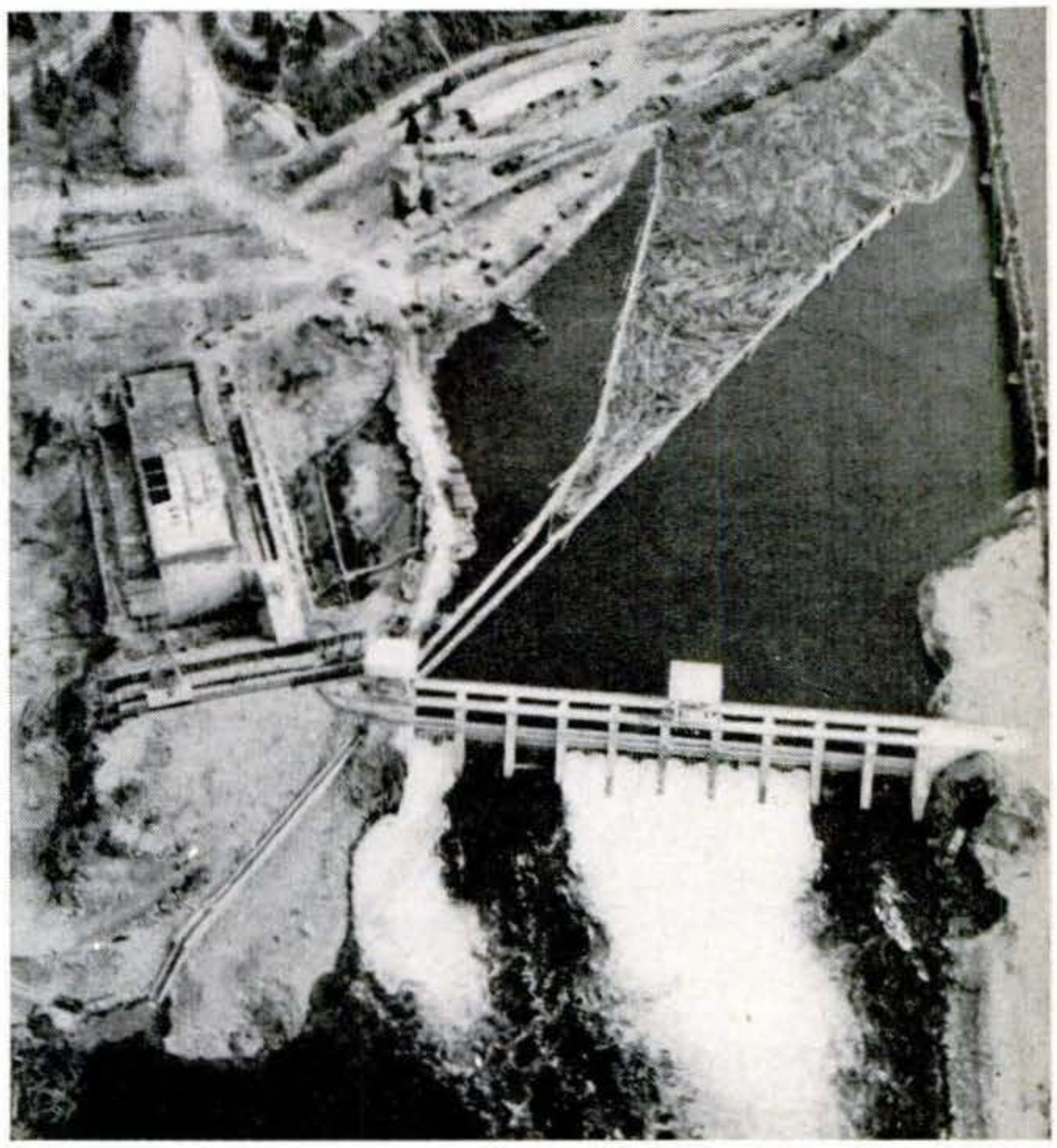
Camera Eye Roves for Underwater TV Shots

THE eye of this underwater TV camera can look all around while the camera itself stands still. A new English lens on the end of a tube swivels in a 90-degree arc like a periscope. The tubular mount moves too, rotating in a full circle. Remote switches adjust the lens, which is surrounded by spotlights.



Logs Shoot the Chute to Bypass Idaho Dam

LIKE the famous "fish ladders" in reverse, a chute funnels logs past Albeni Falls Dam so they can continue their downstream trip on Idaho's Pend Oreille River. A pocket of logs that shot the chute can be seen at the lower left.

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He Shifts Gears with Faucets

Small-town inventor sets out to improve electric motors—and ends up with a fresh approach to auto transmissions.

By E. F. Lindsley

AUTOMATIC transmissions on cars work all right, but there are engineers who are not afraid to try for something better. Count among them Gerald Banning of Zilwaukee, Mich.

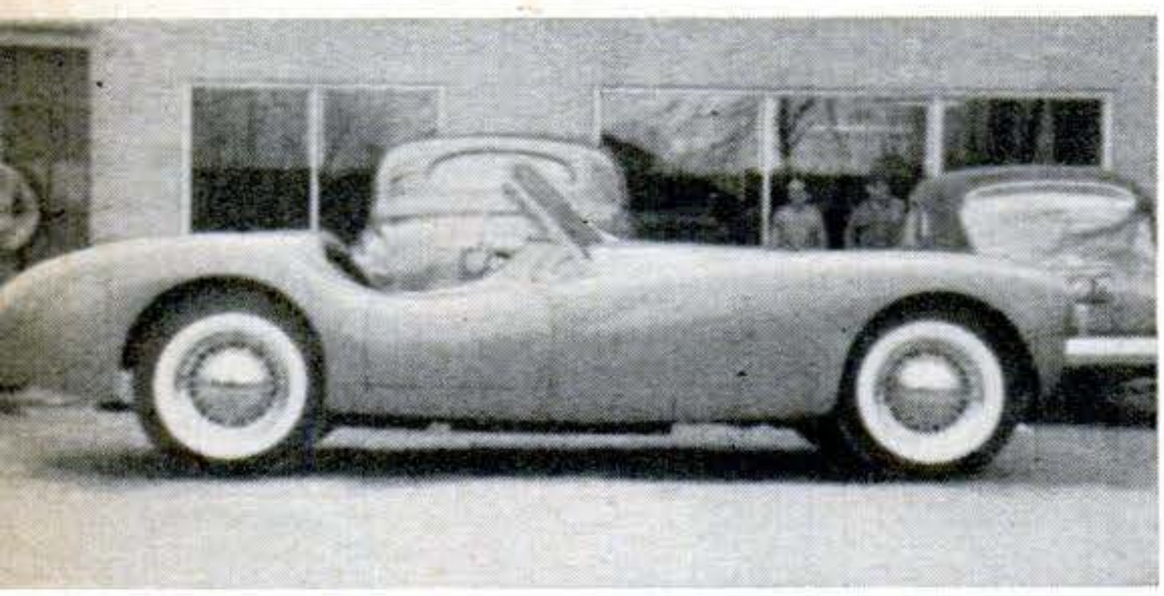
Most auto engineers still live by the old creed that "there's no substitute for inches." Which is another way of saying that even though an engine has plenty of horsepower, it won't satisfy most drivers unless it also puts out lusty torque at the low end of the curve. Which gets down to the fact that drivers want fast acceleration.

Since one of the easiest ways to get torque is with plenty of inches of piston displacement, big engines are bossing the American road—despite added fuel costs, extra weight and murderous top speeds. Smaller engines would do nearly as well if people didn't insist on a big twist on the drive shaft every time they wanted to take out in a hurry.

Gerald Banning claims to have the answer. After watching him put a gutted Jeep through its paces with nothing but a little air-cooled engine for muscle, I'm inclined to think he may be on his way.

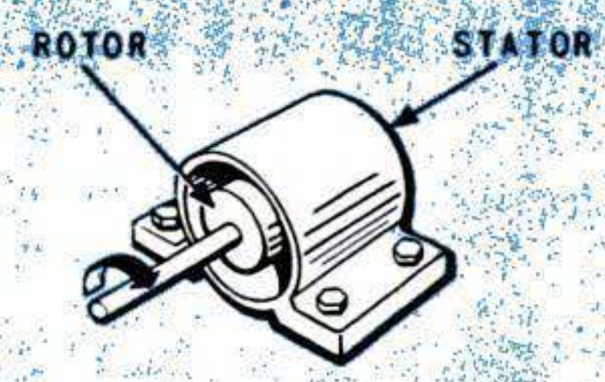
But Banning is an electrical man. Since boyhood he's been winding and repairing motors. He thinks in terms of starting and stopping big machine-shop planer motors, heavy elevators and ship's winches. Just to show what he could do, a couple of years back he built a sports car with an electrical drive.

For power, he used a little air-cooled gas engine that drove a generator. This furnished juice to a special electric motor connected to one rear wheel. With only 20 horsepower, Banning's sports



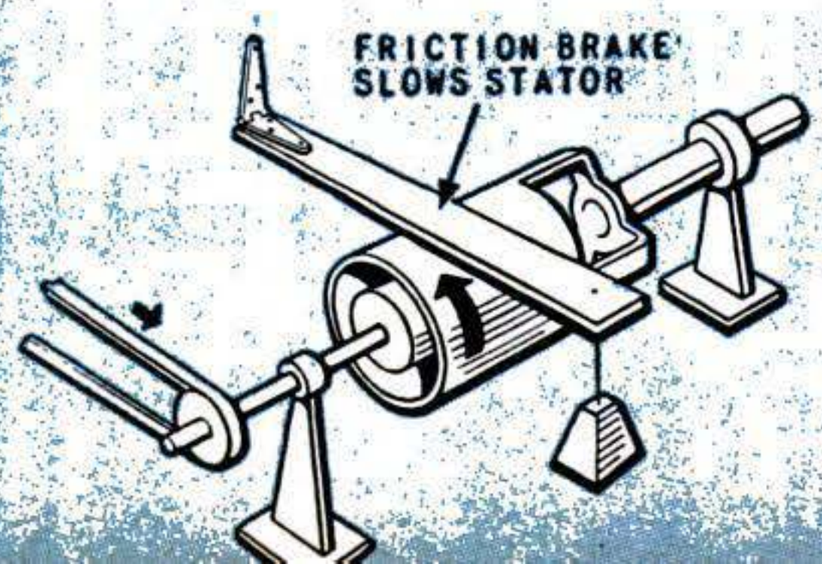
STRICTLY A STUNT, Banning's sports car isn't a speedster. But its electric motor-generator drive lets it develop enough torque from a 20-hp. engine to tow three huge trailer-trucks.

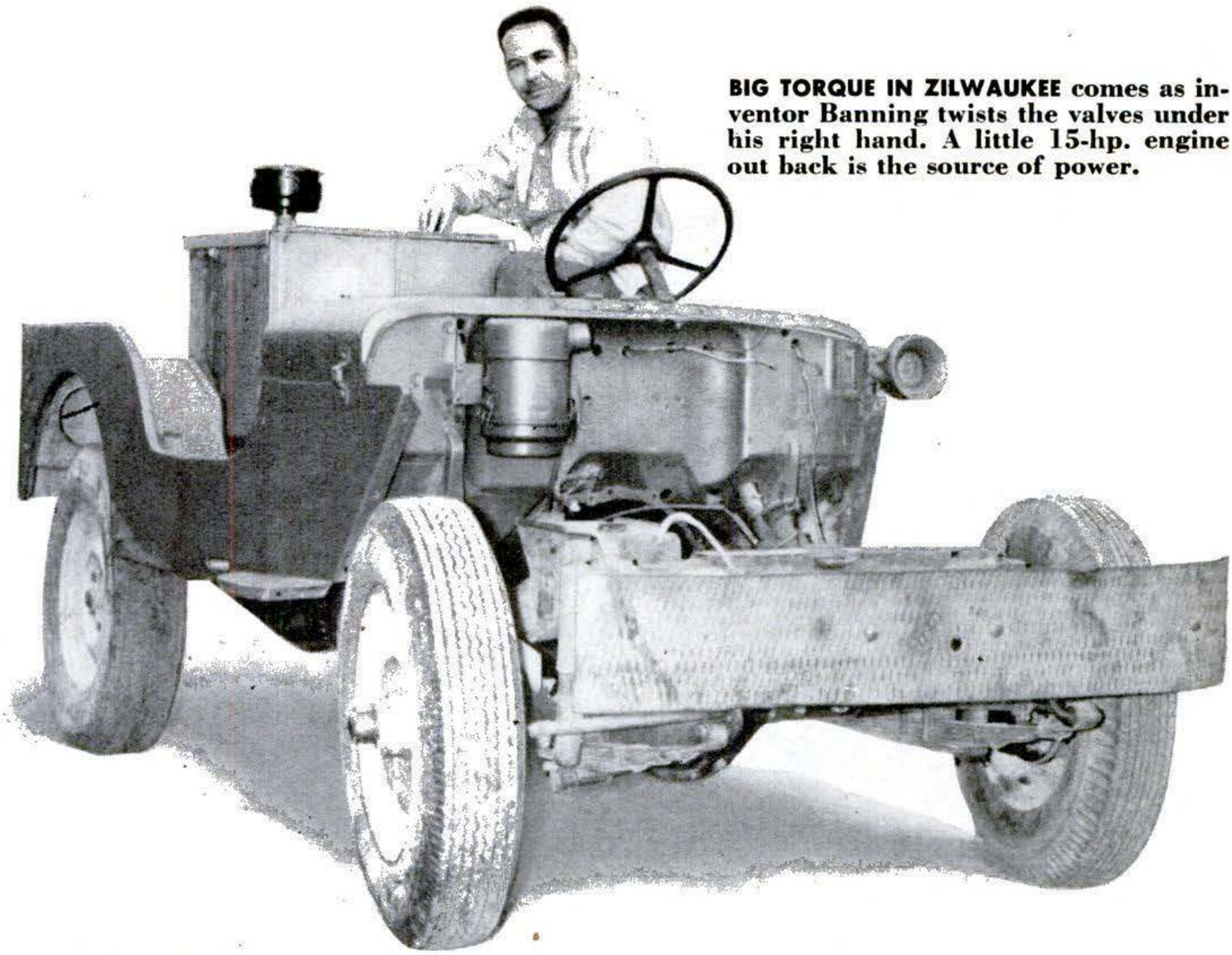
Torque Feedback



1 **Most AC motors** are comparatively weak when starting up, and develop full torque and power only at rated speed. (This is also true of gasoline engines.) Banning's idea is to use reaction torque to help out the start. When running, a motor that delivers 20 pound-feet, say, at the shaft is exerting this force relative to its fixed housing and stator.

4 **If a friction brake** gradually slows down the stator, full motor torque is available to pick up the load. As shaft gets up to speed, the stator is brought to a stop.

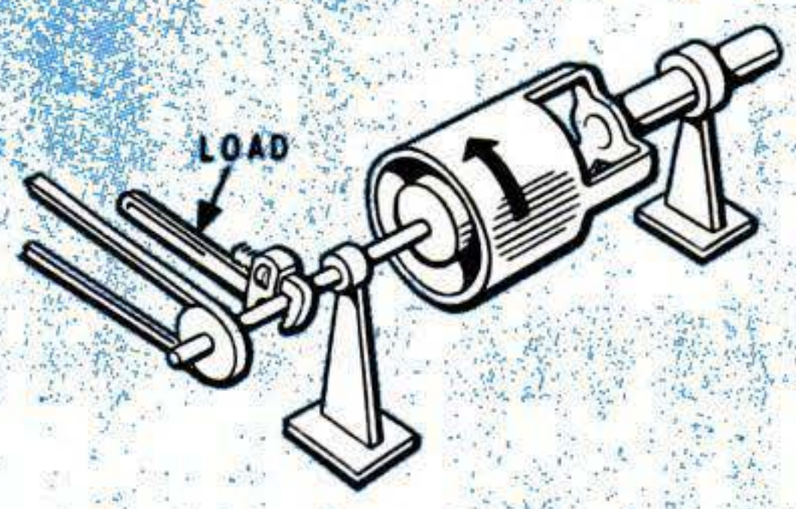




BIG TORQUE IN ZILWAUKEE comes as inventor Banning twists the valves under his right hand. A little 15-hp. engine out back is the source of power.

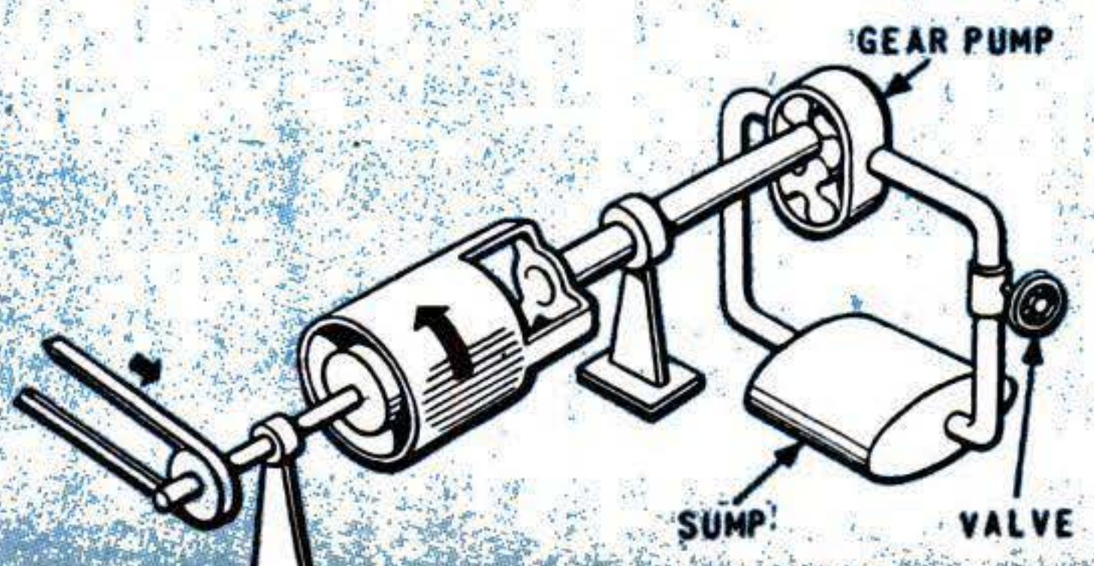
Helps Start His Electric Motors

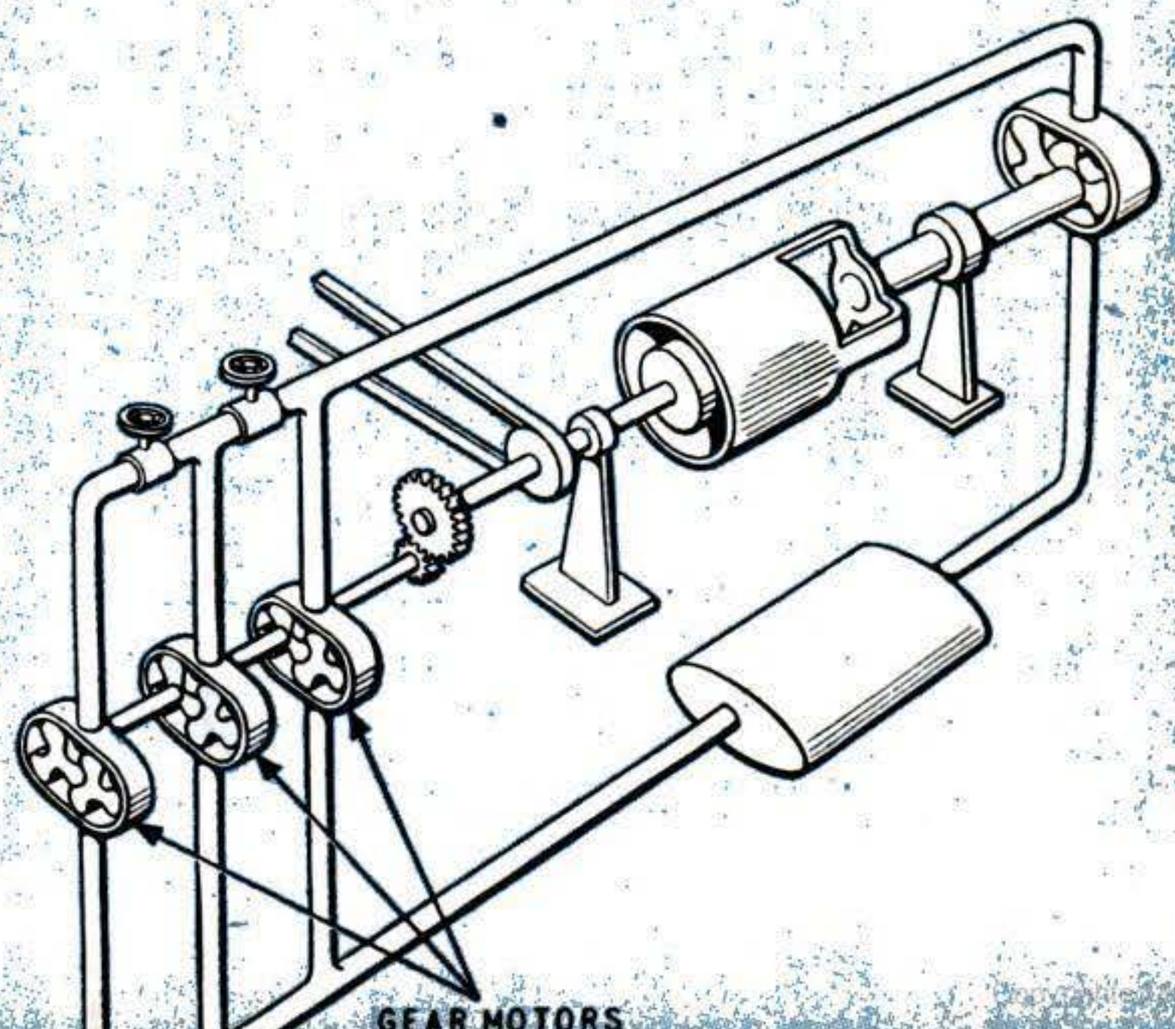
2 **Mount the housing** (stator) so that it can turn backward, and you get something like this. Either part can turn at full speed, or they can divide the total speed between them.

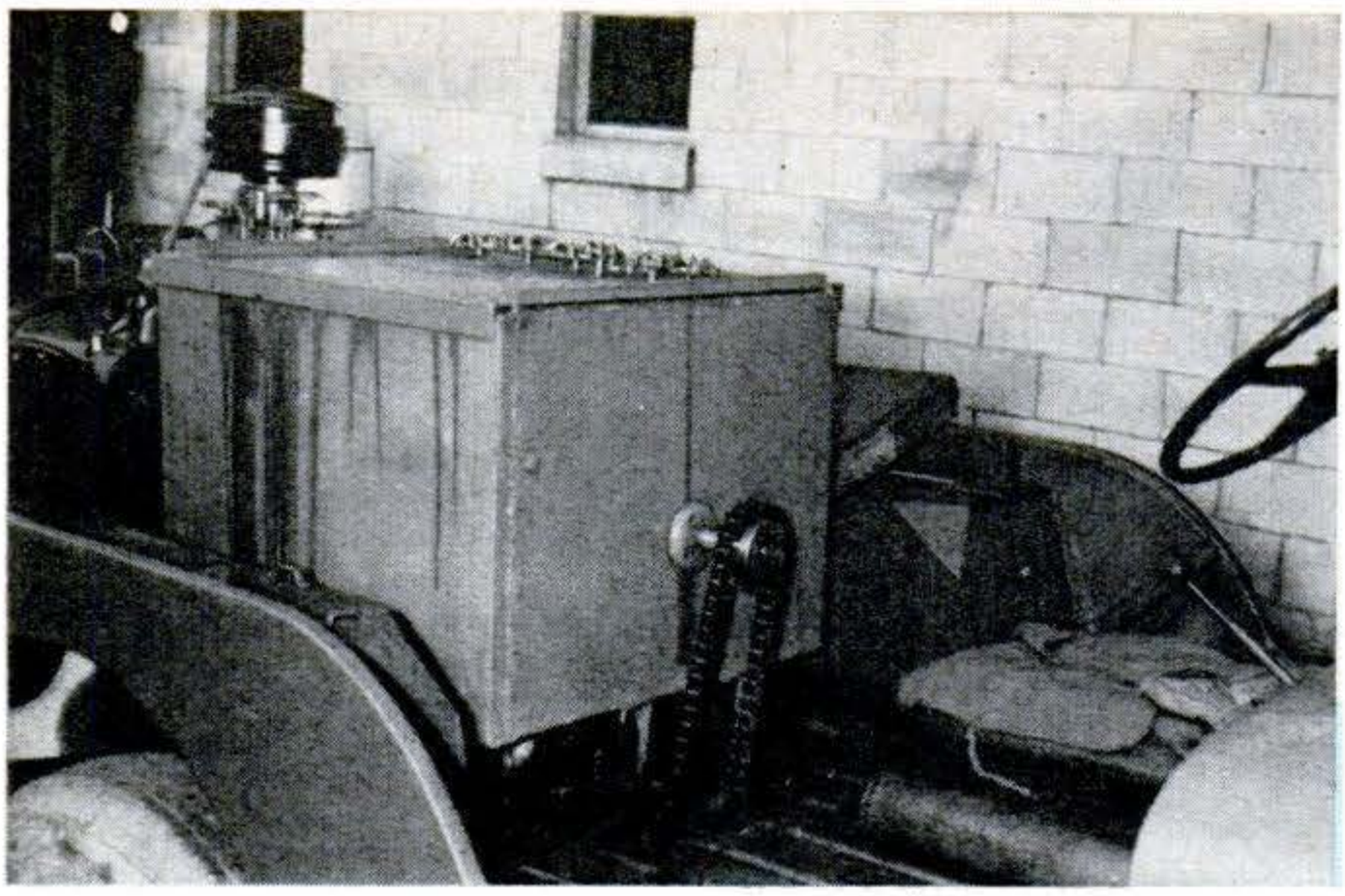


3 **With a heavy starting load** on the shaft, the rotor won't turn. But the stator can and will. When relative speed between them is motor's rated speed, full torque is available.

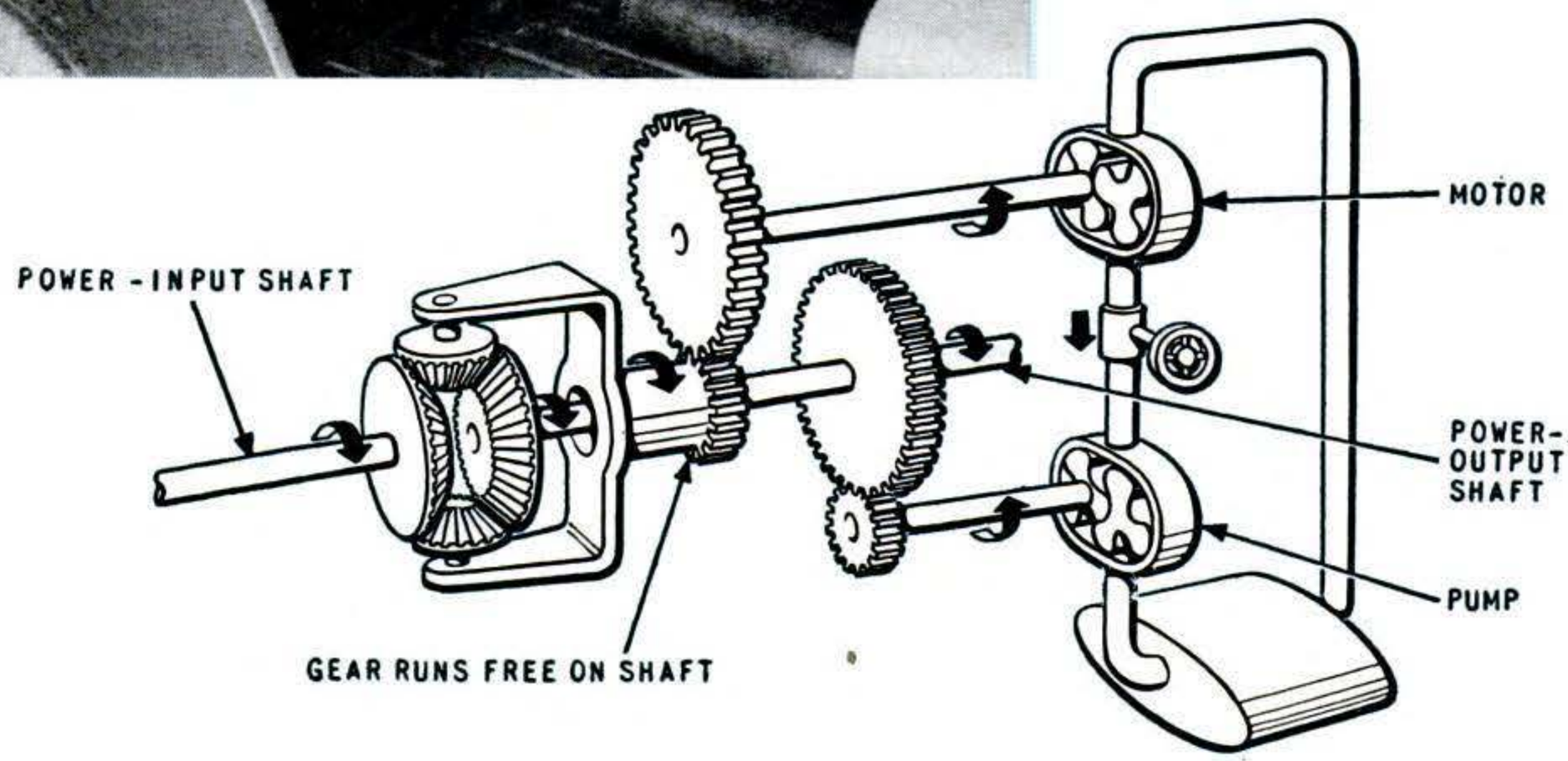
5 **Simple hydraulic brake** below achieves same effect if valve in circuit is gradually closed. But Banning's full rig, right, does not dissipate stator's energy against an inert valve. Instead, hydraulic pressure is led around and, by hydraulic motors, put to work at the task of bringing rotor up to speed.







NON-ELECTRIC TRANSMISSION is in big tank at rear of experimental Jeep (left). Small engine is in back; chain takes output down to drive shaft. Diagram below reveals similarity to electric-motor rig on previous page. Gear-and-pinion cage replaces the stator and rotor. Banning gets a torque multiplication of 5.4 to 1, compared with maximum of about 2.6 to 1 in auto torque converters.



car would scarcely dust a Jag. But by using the ingenious couple-up that he calls Polade Power, Banning got phenomenal torque.

It's easier to follow Banning's idea if you start out thinking in terms of electrical motors—even though his latest transmission, in the Jeep, hasn't anything electrical about it.

Low-Speed Torque Is Hard to Get

The fractional-horsepower motor that runs your bench saw will walk the blade through a two-by-four like cheese. But if you let just one tooth of the blade catch on the wood before you hit the starting switch, the motor stays stalled, the lights dim and the fuse blows. Your saw motor, then, has plenty of power at speed but nothing to brag about in the way of stall torque.

Magnify this picture to the size motor needed to start a big winch—or a car—and you can see the problem that electrical engineers have. For ruggedness and simplicity, nothing beats the AC induction motor. But to get low- or zero-speed torque, all sorts of complications are needed.

Banning must have mused on this problem a long time. When I met him he was unshaven from an all-night session in the shop. Nevertheless, all the concentrated drive of his restless inventor's mind seemed to leap across the desk as sketches by the dozen flowed from his pencil. Starting with the symbols for a rotating armature and its fixed surrounding stator, he pointed out that 20 pounds of torque at the shaft, say, meant an equal and opposite 20 pounds of reaction on the motor housing.

The entire purpose of his idea, he emphasized, is to feed this reaction torque back to the load.

My comment about "pulling itself by its bootstraps" was evidently not new to

[Continued on page 278]

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Tire-Changing the Easy Way—with a Fork-Lift Truck

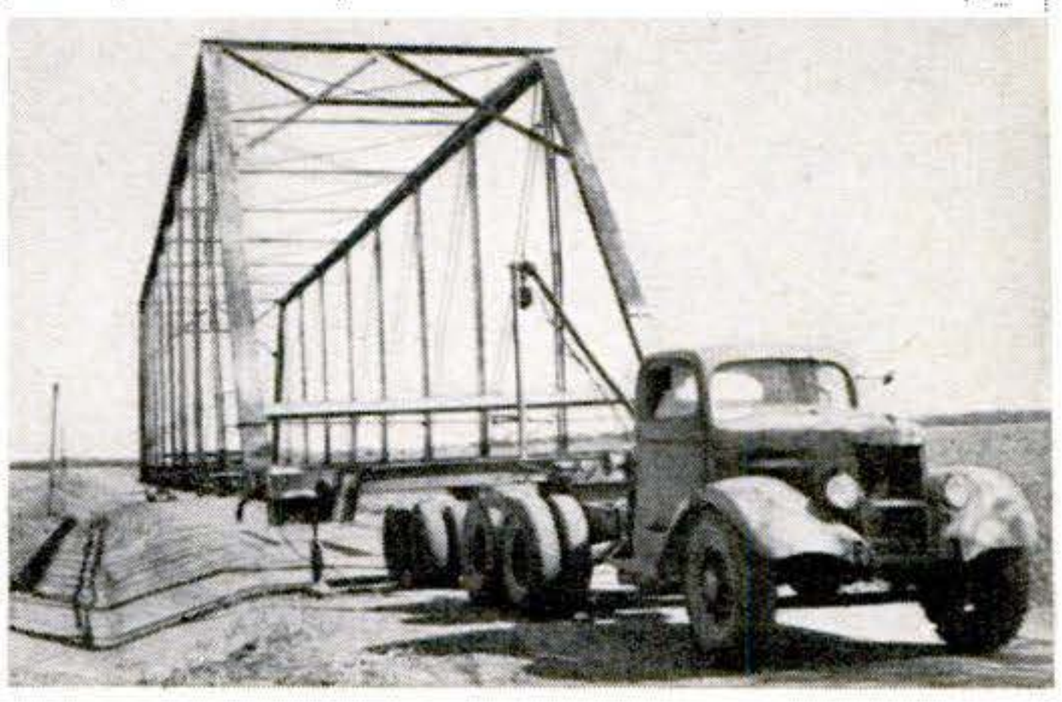
A FORK-LIFT truck hoisted the car for fast tire changes (above) when Chrysler copped the Stevens Trophy at Indianapolis Speedway. Setting a new stock-car track record, the New Yorker De Luxe averaged 89.89 m.p.h. for 2,157 miles in a 24-hour run.

I.D. Badge Checks Radiation

A SINGLE badge protects the health of workers and safeguards plant security at Oak Ridge. X-ray film behind the identification picture records exposure to radiation and is checked weekly. As a new film pack is inserted (right), it ejects the old one.

Claims String-Saving Title

ED FOUTS of Columbus, Kan., began winding up bits and pieces of cord years ago and now claims to be the champion string saver of the world. He figures the whopping 660-pound ball on which he is sitting would unwind to stretch for 338 miles.



Bridge Takes to the Road

THIS bridge on the move was salvaged by engineers building a new span at Solomon, Kan. After a 10-mile journey, it was anchored down at New Cambria—a town fresh out of bridges because the one there had been washed away in a flood.

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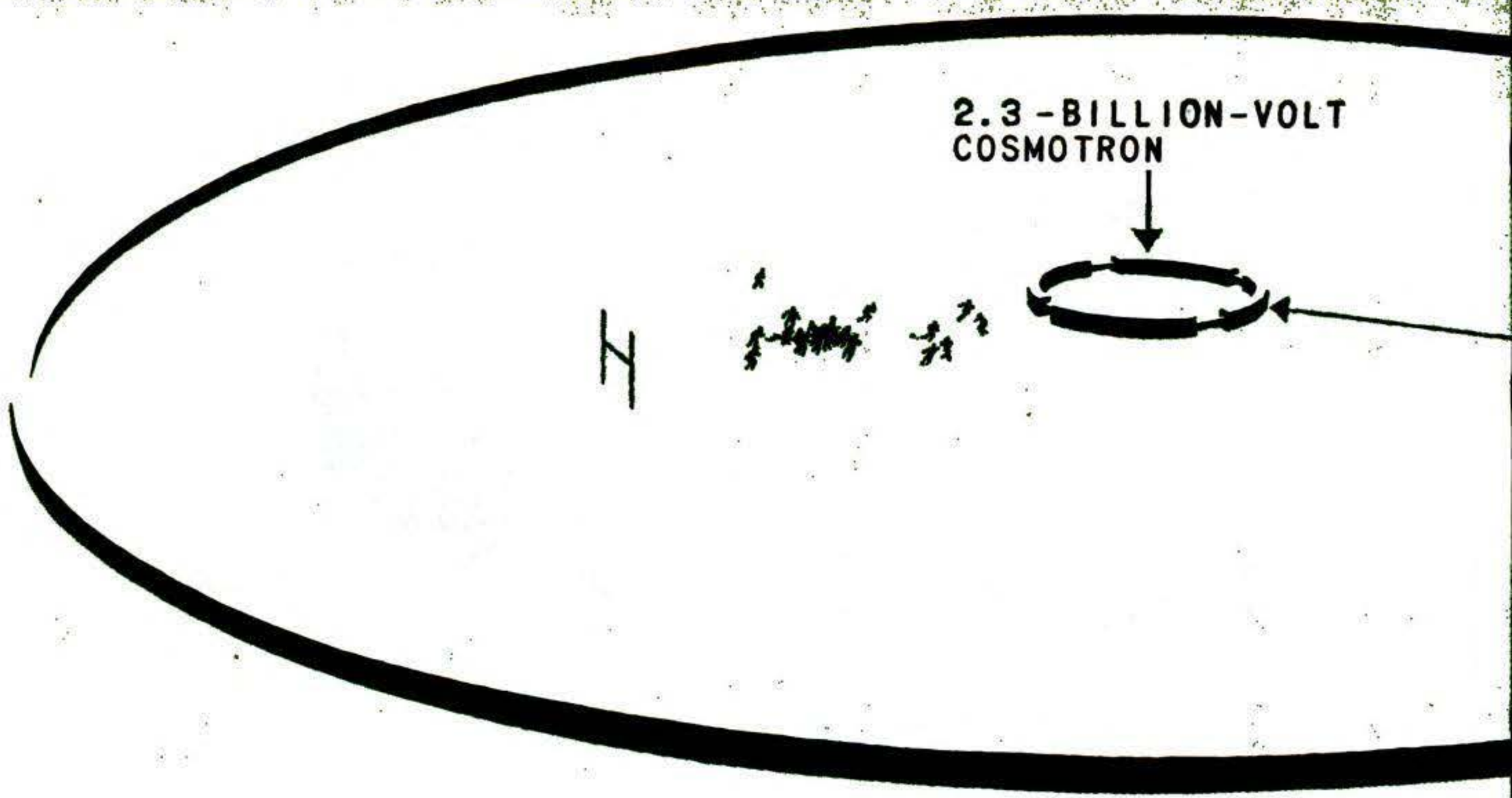

Biggest Atom Smasher to Be So Large a Football Game Could Be Played Inside It

AN ATOM SMASHER 700 feet across and of record-breaking 25-billion-volt power will be built at Brookhaven National Laboratory, Upton, N. Y. Just approved by the Atomic Energy Commission, it should be completed

Family Car Is Lion Limousine

LIONS do like to get out and about—so Tex, pet of the Porter family of Hersher, Ill., enjoys riding with them in a station wagon adapted as a traveling cage. At home, for boarding and alighting, an outside runway leads from his living-room cage to the backed-up car. He's been as far as Florida in his limousine.

Rice-Hull Slab Defies Flame

JUST a thin slab of a fireproofing material made from rice hulls serves (above) as an effective shield from an oxyacetylene torch's flame. Italian inventor Angelo Secondi, who calls the material Secondite, uses this test to demonstrate its fire-resistant and heat-insulating qualities. Wallboard and furniture, he says, can be made from it.

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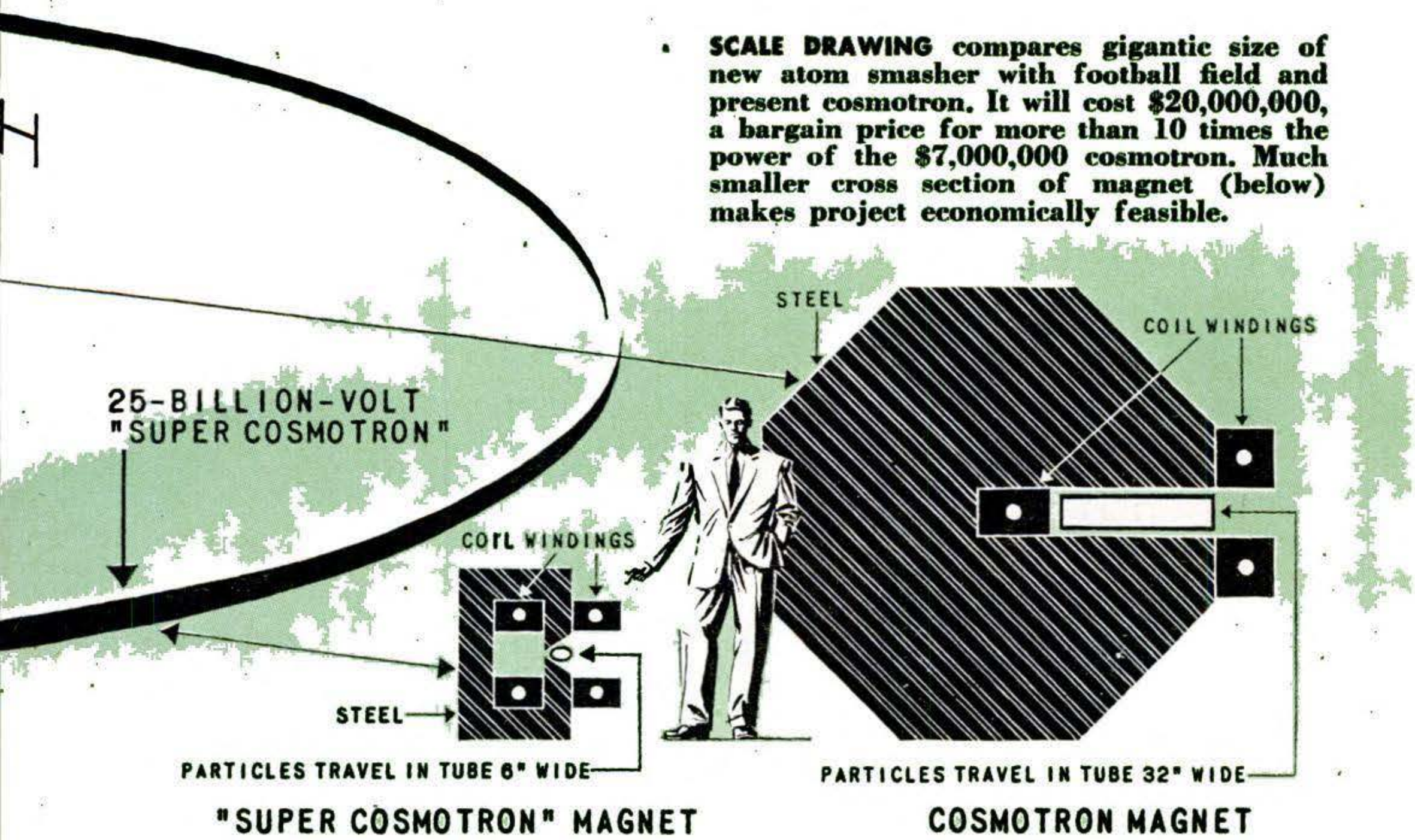
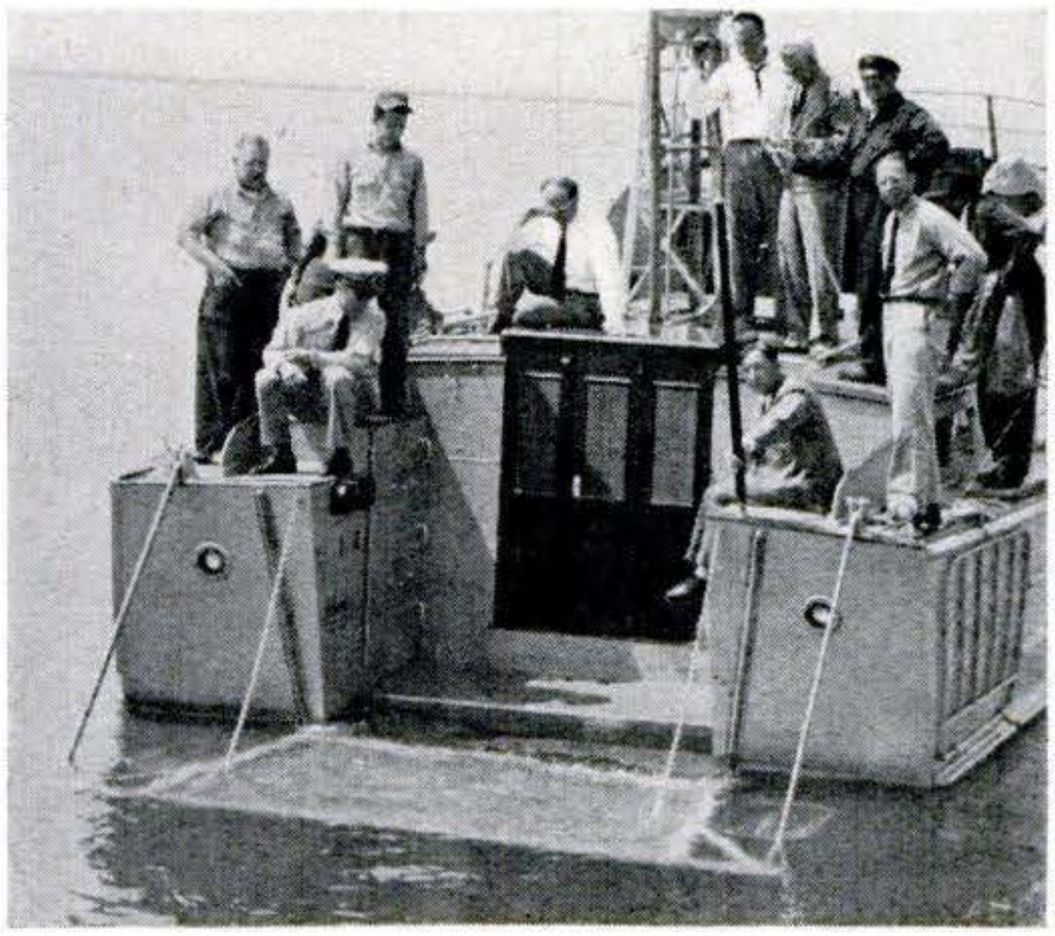
SCALE DRAWING compares gigantic size of new atom smasher with football field and present cosmotron. It will cost $20,000,000, a bargain price for more than 10 times the power of the $7,000,000 cosmotron. Much smaller cross section of magnet (below) makes project economically feasible.

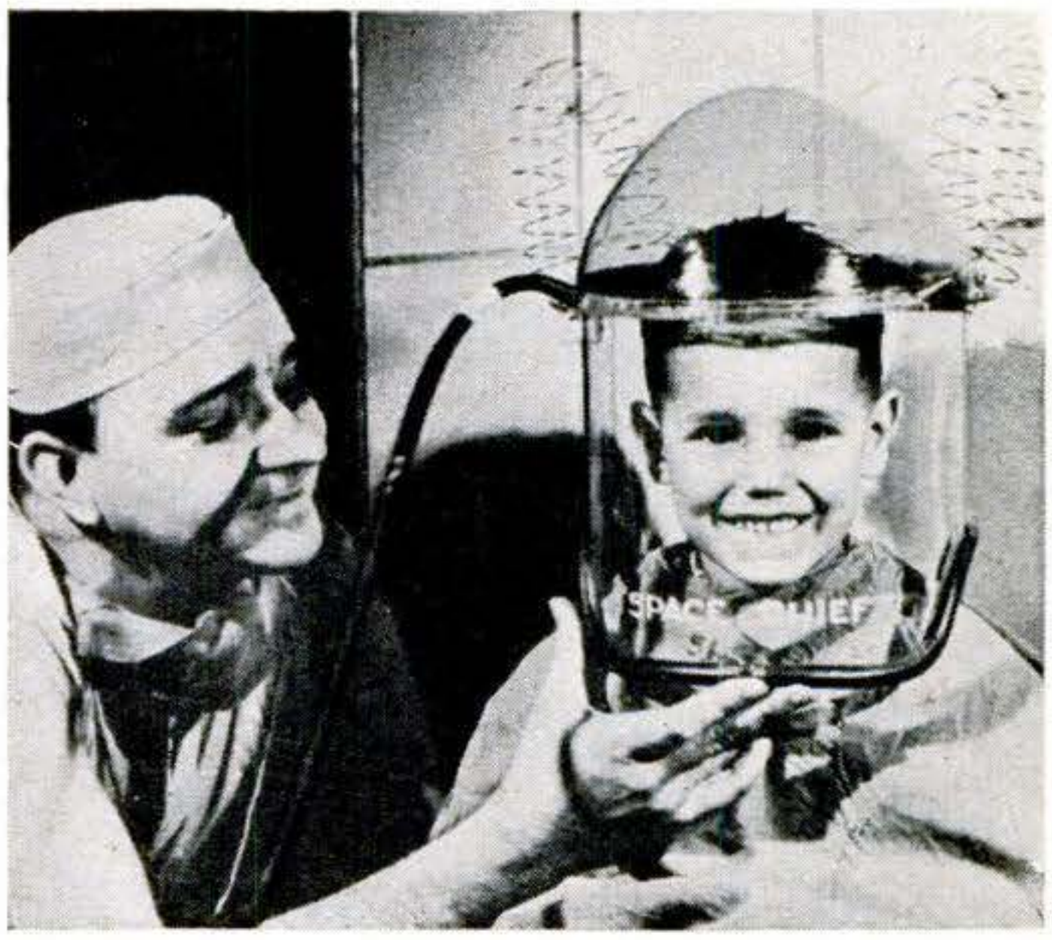


in five to six years. Its newly discovered strong-focusing principle permits its ring-shaped magnet to be of economically small cross section. Thus, only a quarter again as much steel will be needed over Brookhaven's present 75-foot, 2.3-billion-volt cosmotron—currently the world's most powerful atom smasher, though about to be surpassed by the University of California's five-to-seven-billion-volt bevatron.



Tailgate Aids Air-Sea Rescues

FISHING crashed pilots out of the drink will be easier from the Navy's new 52-m.p.h. Chris-Craft rescue boats. A ramp lowered from a self-bailing stern cockpit lets rescuers, standing at water level, pull injured airmen aboard without lifting them over the side. From the cockpit a door leads to a sick bay accommodating four.



Helmet Takes Tots to Dreamland

FOUR-YEAR-OLD Jimmy Bowden, about to lose his tonsils, grins from a "space helmet" that administers anesthetic at the Bethesda, Md., Naval Medical Center. Lt. J. G. Morrow (above) and Comdr. D. J. Giorgio devised it to allay children's fears of operations. Minus tonsils, Jimmy, its first user, agreed: "Pretty smart trick."

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Young

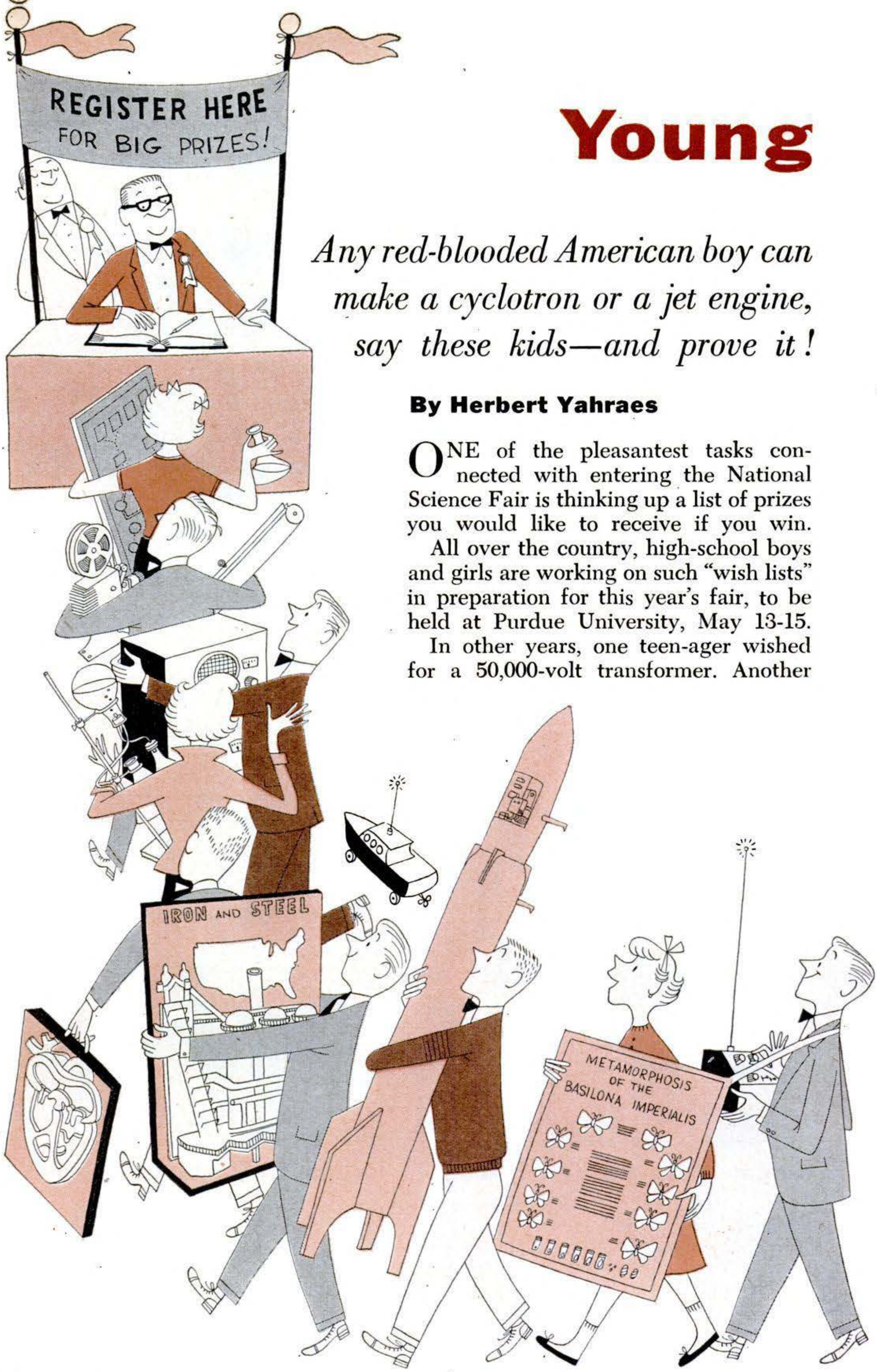
Any red-blooded American boy can make a cyclotron or a jet engine, say these kids—and prove it!

By Herbert Yahraes

ONE of the pleasantest tasks connected with entering the National Science Fair is thinking up a list of prizes you would like to receive if you win.

All over the country, high-school boys and girls are working on such "wish lists" in preparation for this year's fair, to be held at Purdue University, May 13-15.

In other years, one teen-ager wished for a 50,000-volt transformer. Another



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Scientists Win What They Want

asked for a typewriter with a chemical keyboard. A girl wanted most of all an unjointed human skeleton—a bag of bones costing $92.50.

Other students have wished for animal-breeding cages, spectrometers, barometers, oscilloscope kits, Geiger-Mueller tubes, binoculars, encyclopedias, signal generators, soil augers, slide rules, voltmeters and vacuum pumps. They have wished also for distillation apparatus, microscopes, refracting telescopes, sweep generators, analytical balances, terrariums, molecular-weight apparatus, cameras, radios and dissecting sets.

These wish lists are heartening evidence of the ability of our young folks to cope with the world they are growing up in. And the five-year-old National Science Fair, which makes the wishes come true for the winners, is a powerful institution for encouraging the development of this ability.

Entrants are limited to those secondary-school sophomores, juniors and seniors who have won first places in local fairs. This means that there will be about 100 finalists, 50 boys and 50 girls, at Purdue. But the National Fair is only the peak of a pyramid. At its base are some 50 city, state or regional science fairs, averaging hundreds of entries and drawing thousands of visitors.

Among National Resources: Young Minds

Last year the Washington, D. C., fair had 1,000 exhibits, culled from 4,000; Rhode Island had 1,150; St. Louis, 1,700. The Greater Kansas City Science Fair even had an entry from first-graders—about poultry families and their eggs.

"In the ranks of America's young scientists lies the greatest hope of security for the future," the Very Rev. Paul C. Reinert, S.J., distinguished scientist and president of St. Louis University, points

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His $35 Nuclear Reactor Was a Hot Exhibit

Two governments helped Ed Richards of Belleville, Ill., win first place at the 1952 National Science Fair, held at the Smithsonian Institution, Washington, D.C. The U.S. Atomic Energy Commission permitted him to build an animated model of a nuclear reactor. The Canadian Atomic Energy Board allowed him to buy a quarter of a pound of uranium, so he could demonstrate how plutonium and radioactive isotopes are made.

out. "We need desperately an ever growing resource of scientific skill." By stimulating the scientific interest of thousands of youngsters every year, the fairs help provide this resource.

Local fairs are usually sponsored by a newspaper, working with a teachers' committee and frequently assisted by the region's colleges and industries. The national fair is a joint enterprise of the newspapers and of Science Clubs of America, the organization which also administers the annual Science Talent Search (PSM, Dec. '51, p. 144).

A Snooperscope Is Born

One night several years ago the Arthur Richards family of Belleville, Ill., was driving down the Inter-American Highway, in Mexico, with son Ed at the wheel. Suddenly the headlights picked up a herd of goats. Ed braked hard and just avoided a crash.

From this near accident, Ed, a high-school sophomore, plucked an idea for his exhibit at the Greater St. Louis Science Fair—a demonstration of the war-born snooperscope, or infrared converter tube. The device Ed built sent a beam of invisible light into the darkness and presented as a visible greenish image everything it picked up.

Ed's display won first awards at both the local and national fairs. Next year (1952) he came back with an even more complicated exhibit—an animated model of a nuclear reactor. Last year, instead of competing for national honors, Ed entered a special scholarship division of the St. Louis fair with an exhibition on radiocarbon dating. It won him a $4,000 scholarship.

Incidentally, Ed was no lab-bound scientist, but took an active interest in track, wrestling, band, dramatics, and Boy Scout and church work. Practically all of the exhibitors at all the national fairs have been active in such affairs.

Like Ed's nuclear reactor, many of the exhibits betoken a surprising amount of scientific knowledge and of research skill. For example, a Bluffton, Ind., high-school senior, David Michael Young, conducted experiments on rabbits to determine the pressure at which vesico-ureteral regurgitation occurs. This is backflow from the bladder, and it may result in kidney disease. X-ray photographs of the results formed the central part of Mike's exhibit. It won him a first place last spring in the national fair, and last fall he entered Indiana University to make medical research his career.

Stewart Tanner Traill of Bethlehem, Pa., built a cyclotron, an atom-smashing machine. Some of his advisers told him the job was too big, but with the help of physicists from several universities and gifts from a number of manufacturers—including a 775-pound specially machined piece of steel for the magnet—he did it in 1,000 hours.

Her Idea Was So Good She Plans to Patent It

ELIGIBLE to compete for her third National Science Fair this year, Doris Jean Hermes of Martinsville, Va., may become its first three-time winner. Daughter of a textile expert, in 1952 she got a prize for a display of acetate and viscose rayon printed by a method she developed.

Last year she won another prize, by demonstrating a simplified way to dye Orlon. The textile industry is interested and Doris is seeking a patent.

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Larry Collins, who had a part-time job in an Oklahoma City radio-repair shop, actually built a TV color camera and receiver. The two together cost him $200 and two years' work.

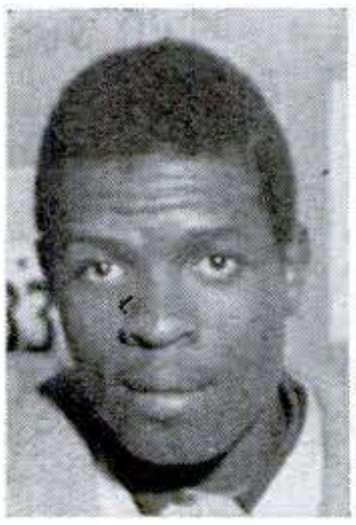
Elton Stubblefield of Denton, Tex., studied cancer in tropical fish and took motion pictures of them in color.

Another photographer, an Ohio boy, was fascinated in school by so-called time-lapse movies, in which you can apparently watch a plant grow. He asked about the process to see if he could make the movies himself. The extra equipment, he was informed, would cost $188. So he constructed his own apparatus and set his camera to take a picture of a seedling every five minutes. The movie became his exhibit.

White Mice and a Rocket to the Moon

Harry Eichelberger of Lexington, Va., found that not much was known about the parasites of mice. So he trapped white-footed mice and studied their fleas, ticks and mites. Peggy Lenderking of Martinsville, Va., exhibited dandelion cigarettes. LaMar Betz of Quakertown, Pa., built a 12-foot cutaway model of a rocket to the moon. Pete Miller, son of a St. Paul, Minn., barber, collected fossils and put them on display with the equipment and books used in classifying them. Helene McFetridge of Philadelphia built her own violin, to demonstrate the laws of vibrating strings.

"That Boy Is a Genius," Said One of His Judges



AT THE Washington, D. C., science fair two years ago, James Brent won first place and the lavish praise of the judges for his exhibit of jet, rocket and steam engines, and a model car capable of going 110 m.p.h. That made him a national finalist. But he had been in military service, was older than his schoolmates and had a wife and child to support. When Howard University offered him a job as a mechanic, Jim quit school.

Pains Taken with Peppers Paid Off in College

MARY HELEN MARTIN of College Park, Md., is now studying biology on a scholarship at Cornell. She got her start with a biological exhibit that won her a first prize in the 1951 National Science Fair. It was a demonstration of the results of her efforts to cross a pimento with a California wonder pepper, in the course of which she had germinated 180,000 seeds and found 466 twins. She treated sterile twins with a drug, got fertile fruit.

Visitors to the 1950 fair could study the internal structure of the earthworm, on view in a papier-mâché model. In 1952 they could consider the similarities between the skeletons of man and animals—with ribbons running from a dog skeleton to a big drawing of a human skeleton on all fours. Last year, visitors could turn a crank and see how the human heart operates.

Other exhibits have shown the effect of radiation on fruit flies, the mathematics of the suspension bridge, the development of the chicken embryo, the workings of 3-D cinema, astronomical photography with a homemade telescope, and a model of a sewage-treatment plant. They have also shown how to produce camphor, chromium, chlorophyll and cosmetics, and how to get molasses from wood.

Penicillin from a Coffee Pot

Many of the youngsters use simple, close-to-home materials for exhibits that win them trips to the national fair.

Jim McMechan of Independence, Mo., brewed some of his father's tobacco in his mother's glass coffee pot and got a nicotine solution. Before he could begin experimenting with it, mold formed. Thereupon he dropped his interest in nicotine and worked up an exhibit on molds. Its high point was the production of penicillin.

[Continued on page 258]

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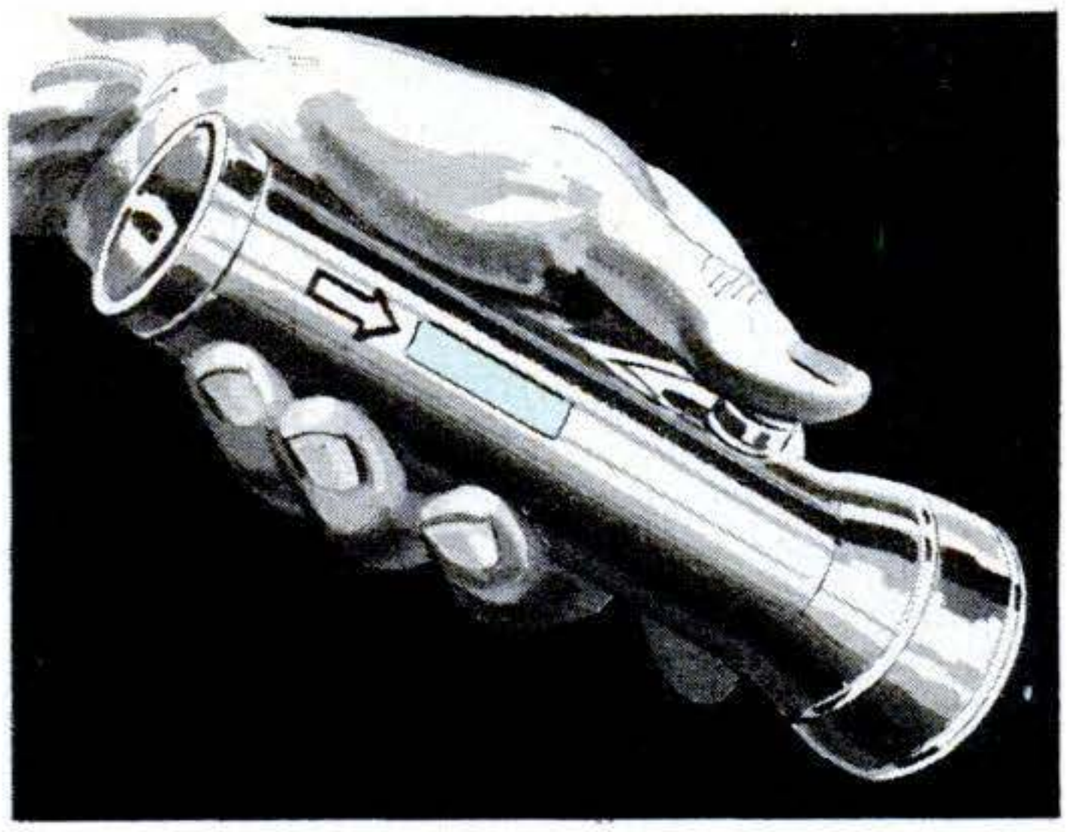
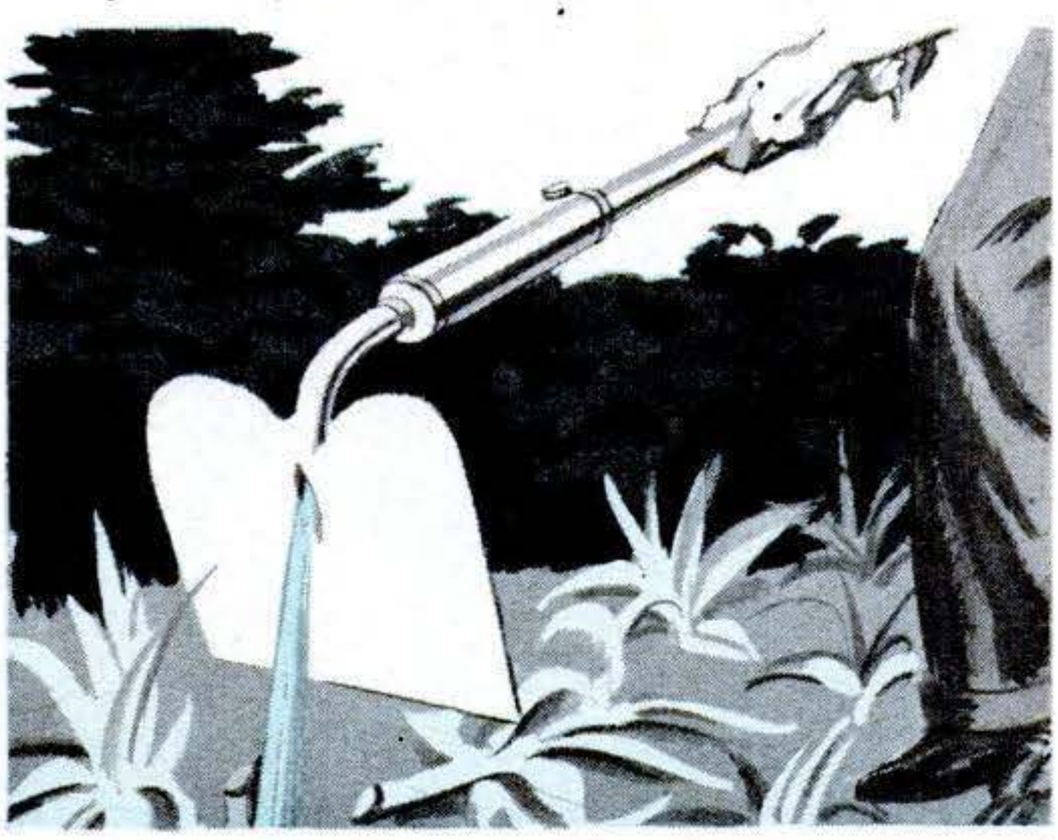
I'd Like to see them make...



DRY BATTERIES that would give warning when about spent. A color-changing indicator behind a window in the zinc jacket would do the job.—*Ayoub Khoury, Latakia, Syria.*

A PULLEY-LINE MOTOR to make handling a heavy wash easier. A hand-set lever could adjust the mechanism to haul out or run in the line.—*Vera J. Stecher, Albany, N. Y.*



A WEED-KILLING HOE. A trigger-operated pump in the handle would feed chemicals through a vent to kill roots of chopped-off weeds.—*A. H. Waychoff, Phoenix, Ariz.*

A WHEELBARROW with wheel farther back beneath the tray so large loads would be more evenly balanced and moved with less effort. —*R. S. Craggs, West Hill, Ont., Canada.*

A CAR HOLDUP ALARM that could be set off from the driver's seat. Location of switch would be concealed so gunman could not turn it off.—*George Walton, Pasadena, Calif.*

Everyone has his own pet idea of a gadget he would like to see in general use. The five ideas illustrated above were suggested by PSM readers. What is YOURS? We will pay $5 for each one published. Please use government postcards only. Contributions cannot be acknowledged or returned.

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RECORDING THE YELPS of a cornering tire (right), a Goodrich engineer adjusts the mike of a tape recorder.

Rubber Knobs Squelch the Squeal in Tires

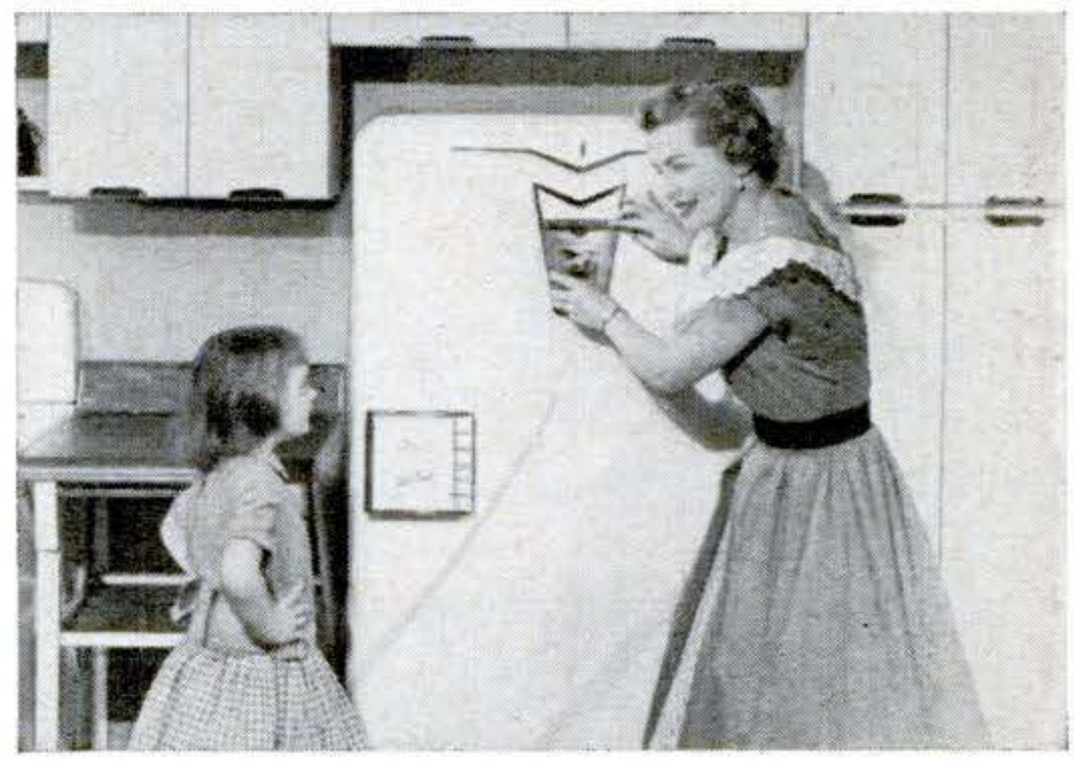
TIRES squeal when a car rounds a corner because their tread ribs are shuddering from being wiped sideways across the pavement.

In recent years, while cars have tended to become steadily heavier in the front end and power steering has made cornering easier, tire yelps have been louder than ever before.

Now two leading tire manufacturers have nearly stifled the squeals. Goodrich and Firestone have molded semicircular rubber knobs into the gutters between tread ribs. These knobs steady the ribs under side pressure and keep them from vibrating noisily.

Motor Flexes Metal Awnings

THE new aluminum awnings above can be extended or retracted at the push of a button. The panels of each awning are attached to pantographic arms. The arms are flexed by a 1/20-horsepower motor, with gear reduction of 600 to 1, which operates a camshaft arrangement.



Refrigerator Has Door Tap

IF SISTER works up a powerful thirst and keeps coming around for another drink of ice water, the mother above doesn't have to open her refrigerator repeatedly. Instead, because it is a new Crosley Shelvador, she gets her daughter a refill by simply pushing the button of a door tap.

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Stilts Get New Look, New Jobs

ONE morning some three years ago a crew of lathers arrived on the job in Phoenix, Ariz., without their scaffolding. Someone had forgotten to bring it. Then and there a new industry was born, and you would never guess what:

It's making stilts! More than 80,000 pairs of the things have been manufactured, and 20,000 more are on order.

The lathers who forgot their scaffolding were headed by a chap named Bob Skaggs. Bob figured that he could waste two hours going back to the plant for it, or he could improvise.

He improvised. He searched through lumber scrap until he found some wood suitable for makeshift stilts. With them, the lathing job was finished on schedule, in time for the plasterers. That night he told his partner and brother, Everett, about it. Everett added his own idea.

Result: Skaggs aluminum stilts—now used not only by lathers and plasterers but also by carpenters, masons, electricians, decorators and homeowners.

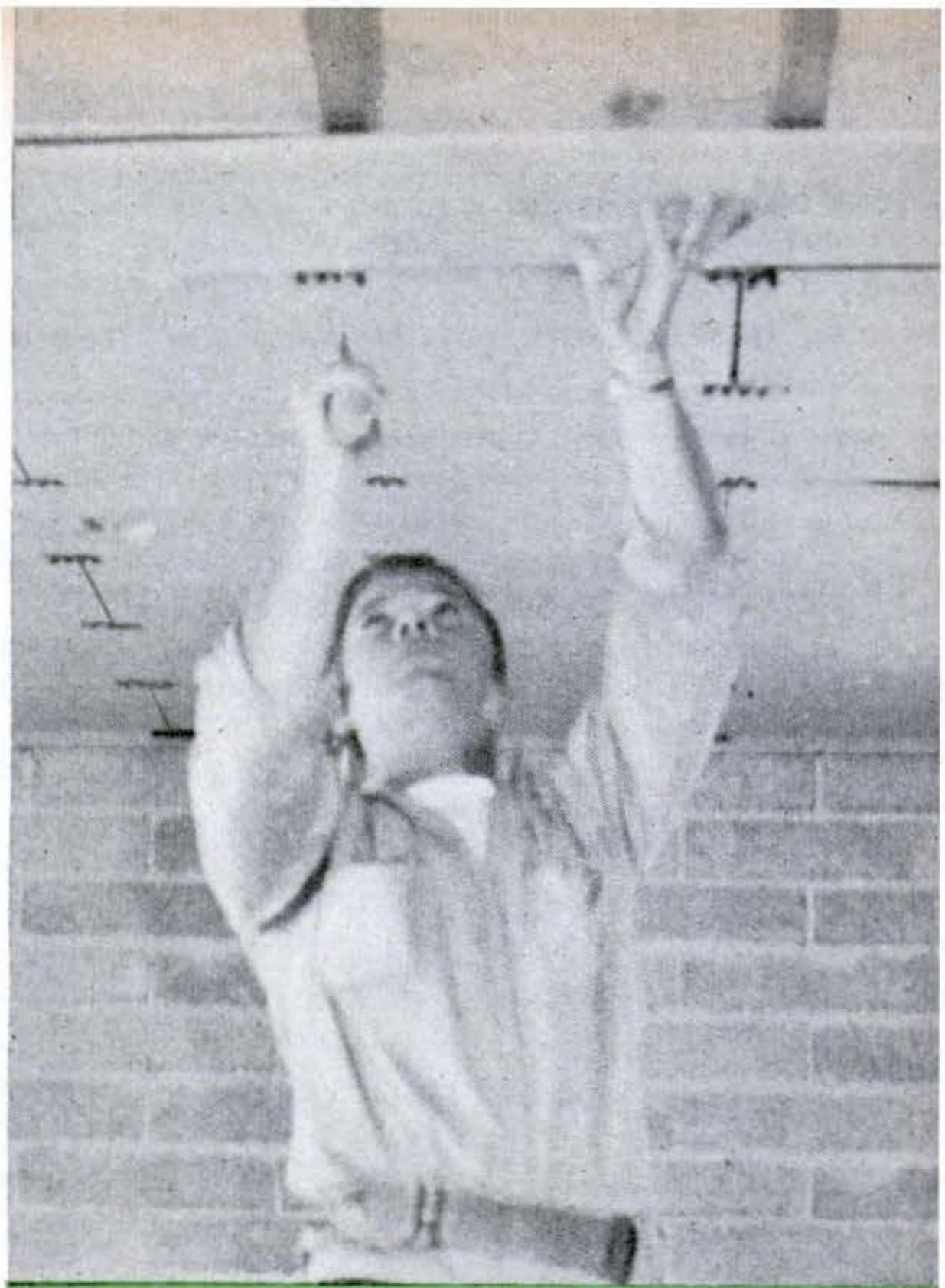
Stilts save time. Putting up scaffolding sometimes takes hours; stilts can be buckled on in less than a minute.

Small Fry Like Them, Too

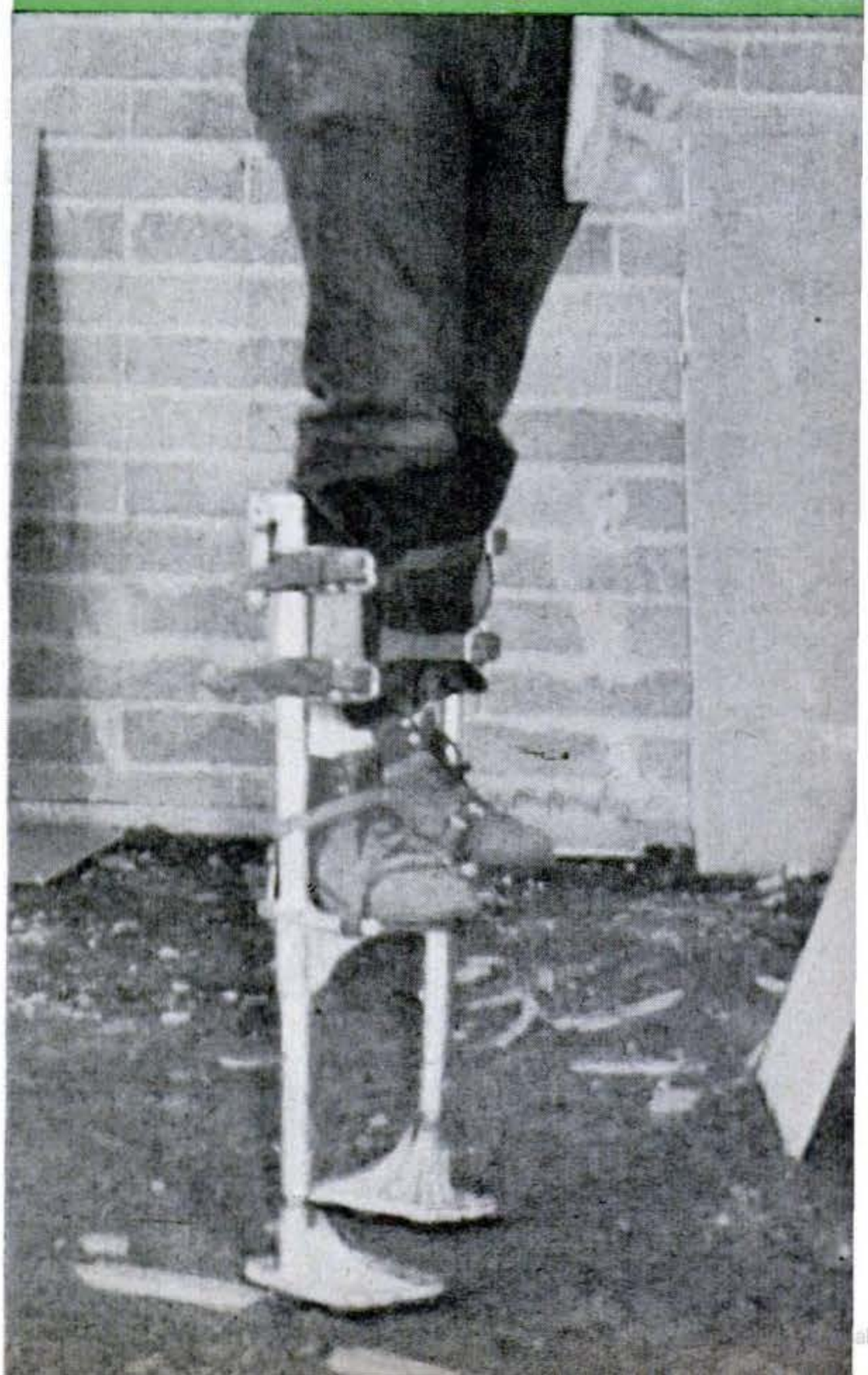
Homeowners are using Skaggs stilts for painting, cleaning out eaves, window washing and wallpapering.

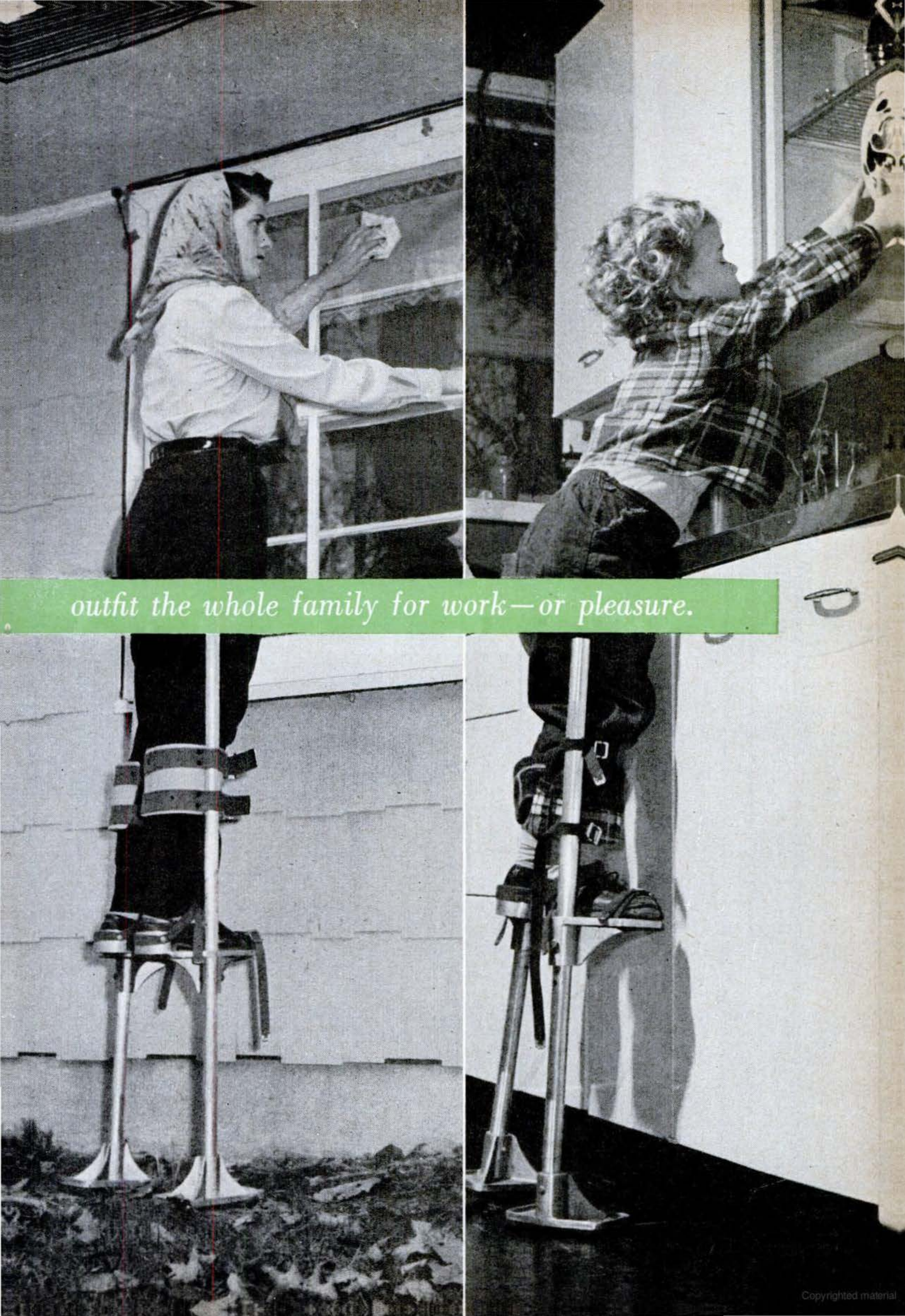
Once stilts for adults caught on, smaller ones for Junior were inevitable. Stilts for the small fry were a sort of happenstance too. Everett Skaggs' three-and-a-half-year-old daughter began pestering her dad for stilts. He made some for her. You can guess what that did to the neighborhood children.

So the Skaggses started making kids' stilts. Currently, the little stilts are outselling the big ones. END



"Strap-on stepladders"





outfit the whole family for work—or pleasure.

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Gus Defies the Elements

By Martin Bunn

BLACK thunderheads were piling up on the horizon, blotting out the late sun of an April afternoon, as Gus Wilson tossed his tool kit into the back seat.

He wished he could send Stan Hicks, his young helper, on what promised to be a routine but uncomfortable job: a truck stalled in the hills with ignition trouble. But Art Robler's truck line was a new outfit in town and a prospect for considerable steady business. Gus wanted the Model Garage to make a good first impression.

He drove with a wary eye on the sky. Outside of town, a sudden torrent of wind-driven rain lashed across the windshield. Gus finally came down into the narrow canyon that held the torrent of Rolling Rock Creek, to find the truck, attended by one of Robler's drivers, a slender, youthful fellow in wet dungarees. The front wheels of the truck had sunk into the soft shoulder of the road until the pan rested on the ground.

Truck Is Still Partly on Road

Gus found himself regretting that he hadn't brought his tow truck, until he noticed that the dual rear wheels of the truck were still on the road. They'd have no trouble backing the outfit onto the highway, once the motor was fixed.

"I'm Gus Wilson of the Model Garage," he told the driver as he got out of his car, tool kit in hand. "Robler phoned me that you were having trouble up here. Looks like a nice day for ducks."

The truck driver was hanging on to Gus's arm, shaking it. "We've got to get out of here!" he cried.

With flood water swirling at

"Ducks is right," the driver agreed, grinning. "Holloway's the name—Steve Holloway."

"Glad to know you, Steve," Gus said heartily. "Now what's your trouble? We'd better move fast; this storm's turning into a real cloudburst."

"Nothing much wrong," Steve assured Gus. "The stud that holds the distributor shaft came loose, and the thing worked up out of gear. I tried to put it back but didn't have much luck."

"We'll fix that in a hurry," Gus said, lifting one side of the hood and placing

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his feet, Gus finds a magic wand in his own tool kit.

it on his broad back to shield the ignition wires from the rain while he peered at the motor.

This was going to be easy, Gus told himself. The driver had pulled the distributor, shaft and gear completely out of its recess hole in the block, first disconnecting the attached automatic spark vacuum-control tubing. Gus thrust his screwdriver blade into the flywheel-timing hole, prying the flywheel around by its teeth until No. 1 firing indicator showed, so that he could time the motor quickly when he shoved the distributor back in gear. Below the gear there was a keyway that slipped into a key on the oil pump below. All he had to do, Gus thought, was to drop the shaft back in with the gear set for No. 1 firing, wiggle it to engage key and keyway, and put the retaining stud back in.

Such retaining studs normally had short-coiled springs, held down under a flat washer, so that the distributor could move back and forth in the retaining-stud slot, for manual spark control. Before attempting to put the distributor shaft back in its foot-deep, inch-wide recess hole, Gus used his pencil light to look for the five-sixteenths retaining

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stud and its spring, hoping to find them lying on the splash shield.

He quickly found the stud, its washer still on it, but couldn't locate the spring. Oh, well, he thought, he'd just put on a lock washer and lock the distributor in advanced-spark position.

Assembly Won't Go Down

Gus picked up distributor and shaft, attempted to thrust it down in and seat it. But the assembly wouldn't go fully down on its seat on the crankcase. The shaft had a resilient, springy feel. The thought came to Gus that he had located the missing spring. Sure as shooting, it had dropped down into the shaft hole when the driver had lifted out the assembly.

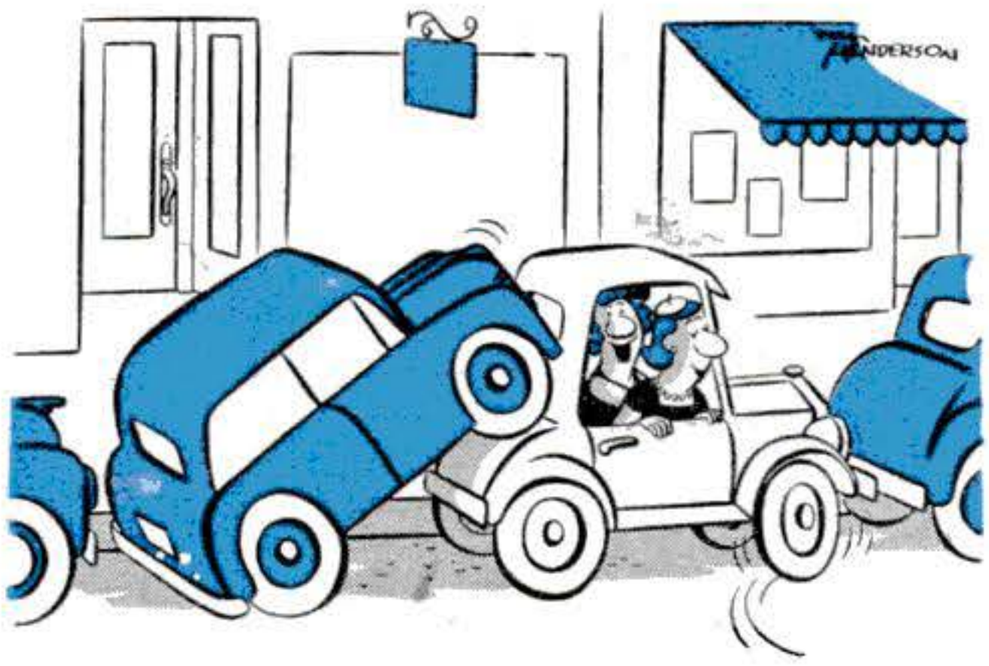
"How're you coming?" Steve Holloway yelled above the drumming rain.

"Not so good," Gus shouted back. "A little spring has dropped down there on top of the pump shaft. I've got to get it out some way."

Gus backed out from beneath the hood to stand in thought beside the truck. His eyes moved to the waters of Rolling Rock Creek, which were rapidly rising to an angry, raging torrent with the rain.

If it was raining this hard here, Gus knew it was probably coming down in solid sheets higher up. The creek would be over its banks in 10 minutes. There was plenty of loose timber slash above, from logging operations, that would come drifting down like battering rams. If they were still here then, anything could happen, with the truck so close to the stream bank.

Even as Gus stood there, he saw a tangle of driftwood come down the white-maned stream with the speed of an express train. Cold chills ran up his spine as he turned his attention back to the disabled truck.



"For a minute I thought this space wasn't gonna be big enough!"

He grabbed a long-shafted screwdriver and began probing for the offending spring. If it were standing on end, he thought, he could get the driver blade inside it, and by side pressure ride it up to the top.

Or if it were on its side, he could just poke the screwdriver blade between its coils and lift it out.

It sounded easy, but it wasn't. The spring was lying on its side but fitted so closely in the bottom of the distributor-shaft hole that when Gus drove the screwdriver blade between the coils, the spring opened to wedge tightly against the recess walls. He tried to turn it with the end of the driver blade, and found that he couldn't. It was an exasperating deal. He worked carefully and slowly, fighting rising apprehension.

A low rumble started up the creek, gaining in crescendo, and the ground beneath Gus's feet shuddered. The big, round boulders at the creek bottom were being rolled thunderously by the rapidly rising water. Great fallen logs came down, creating dams in the narrow canyon that flooded the road. He had seen this spot where they now stood, Gus thought, running four feet deep with water and whirling driftage. Nearly every year the highway crew had to come out and clear it after the flood receded.

Holloway Warns Gus

Gus felt cold water run over the tops of his shoes, and he jerked his body from under the truck hood just as the driver catapulted from the cab where he had taken shelter and grasped Gus's arm.

"We'd better be getting out of here before we get drowned," he shouted. "Water's coming up over the road. A log . . ."

[*Continued on page 260*]

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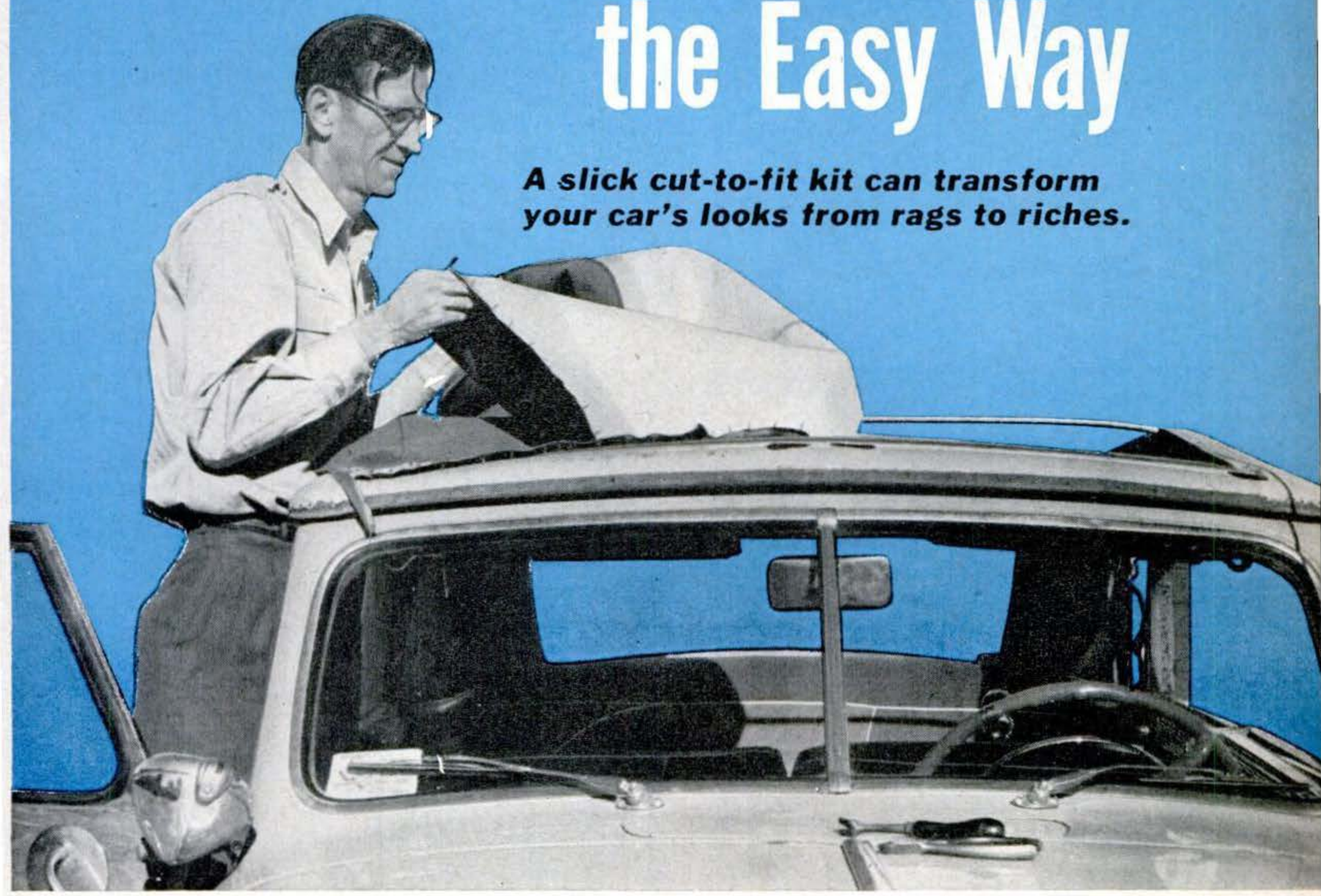
It's a One-Day Job

Retopping a Convertible the Easy Way

A slick cut-to-fit kit can transform your car's looks from rags to riches.



By Bob Gilmore

IF YOUR convertible needs a new top, you can get it in one of three ways. The executive way: Have your secretary ask a garage to pick up the car, retop it and bring it back tomorrow. The hard way: Use the old sagging top as a pattern, overwork the family sewing machine stitching seams in heavy material, then tug and try to make it fit. The smart way: Buy a ready-cut kit.

You can get a kit for your make and model (for MGs too) from an auto-parts store or right out of a mail-order catalogue. All the work of cutting, sewing, binding and snap fitting has been done, leaving you little to do but tack it in place.

When ordering, be sure to give the year, make and model number of your car. Specify color from a choice of tans, greens, black or natural, and indicate the grade of double- or triple-ply cotton fabric you want, or choose a vinyl-impregnated fabric for a few dollars more. You can alter the styling of your car somewhat and improve your rear visibility by ordering a full-width rear window. If your car is a '48 model or newer, you have plenty of styles and fabrics to choose from.

To see how to take off the old top and put on the new, please turn the page.

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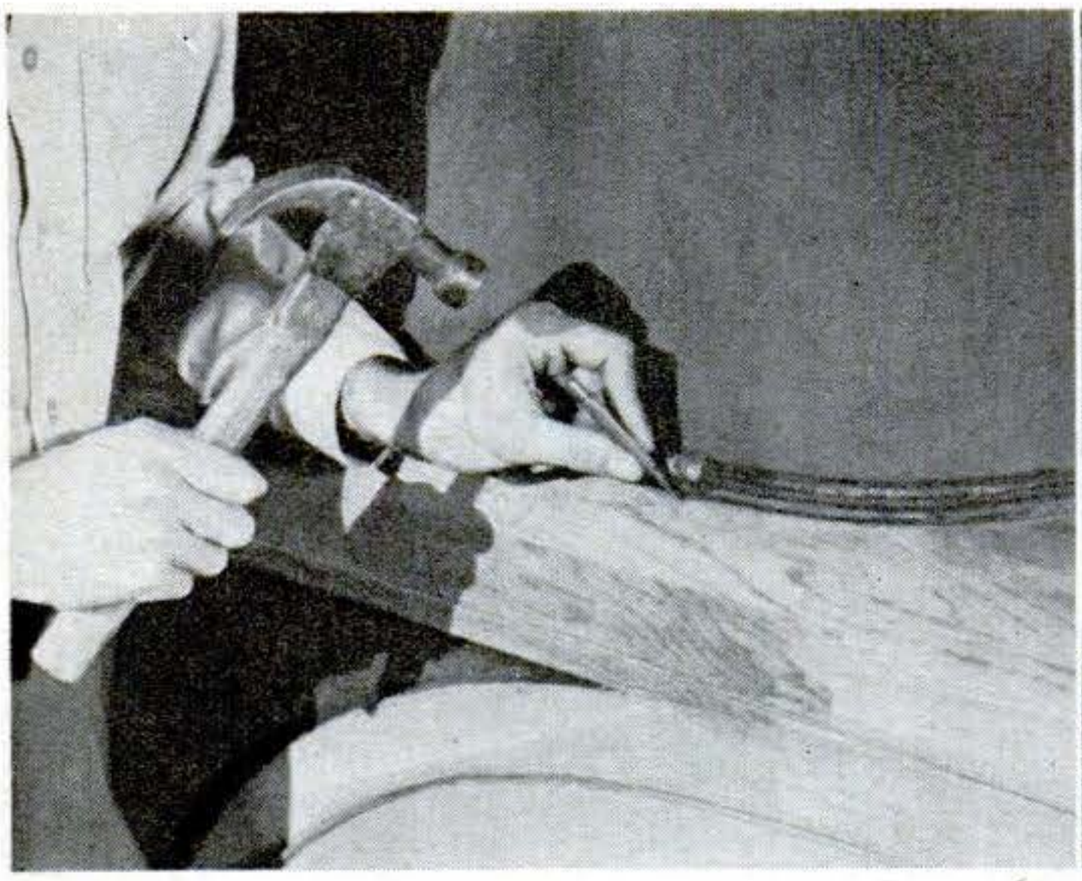
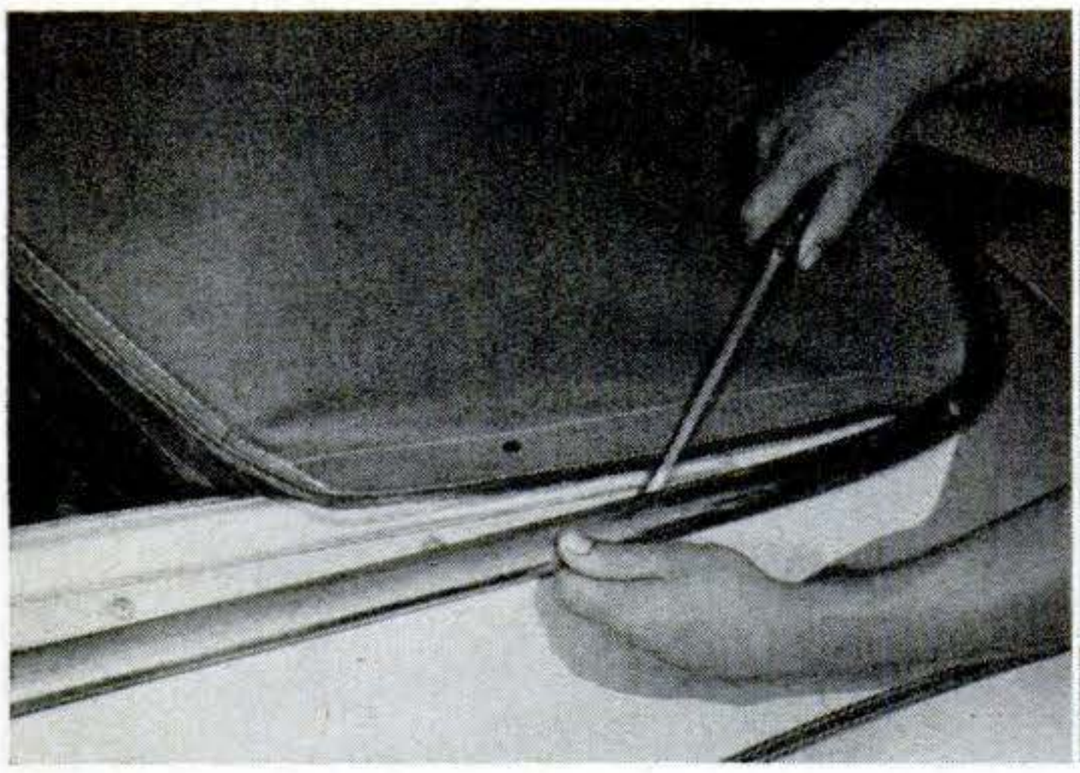
Off with the Old Top . . . . . .

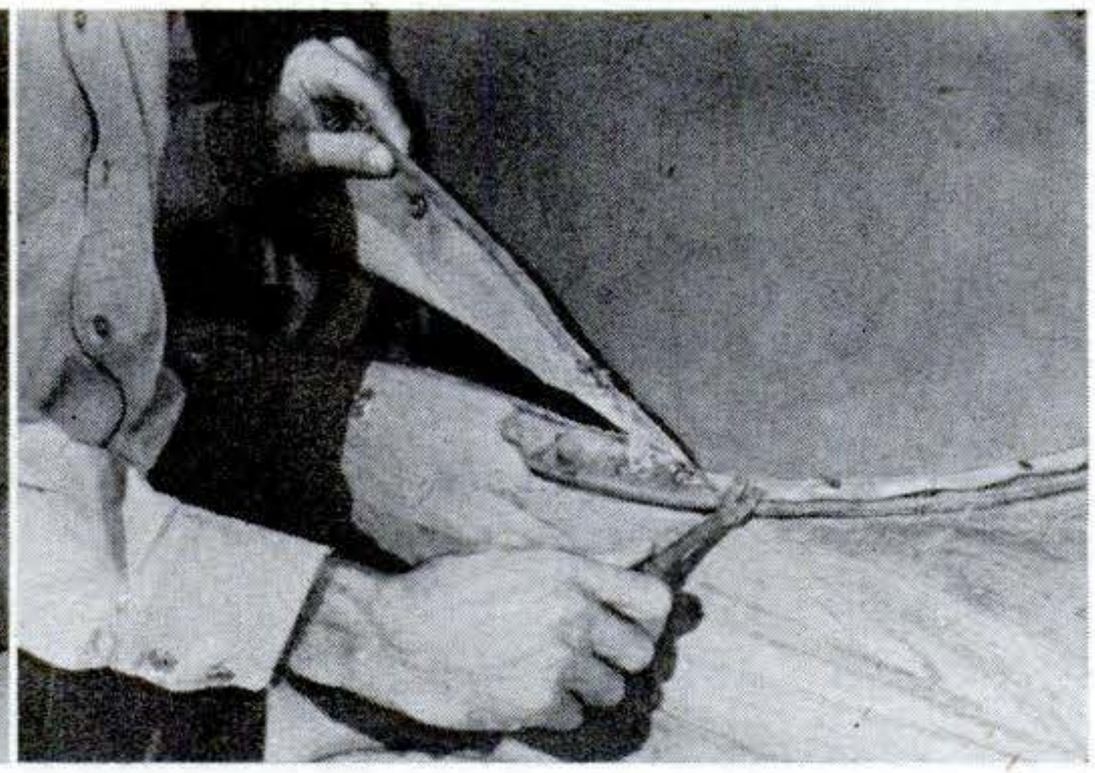


1 Before stripping old top off, mark location of screws in welt ends, position of side seams and center of rear flaps. Use punch to mark wood body, but stick little triangles of masking tape at these points if body is metal.

2 Spread welt apart and pry upholsterer's tacks out with a screwdriver. Usually, after a foot or so of the welt has been freed, the rest of the piece, including tacks, can be pulled up quickly and easily with a few sharp yanks.



3 Metal trim strip is sometimes used instead of welt. Pry it up with firm pressure of screwdriver. Strip is C-shaped and is only snapped over backing strip on sides of body. Remove screws holding strip over fabric.



4 Pull last few tacks remaining under welt with claw tack puller. Screwdriver would do, but one slip might spoil your car's paint job. Gather up the tacks as you pull them—they'll be picked up by your tires if you don't.

5 Pull side-window weather-strip gasket out of its metal retaining frame and remove screws that hold frame over top flap. Finally, free old fabric by pulling out tacks in welt over windshield. Leave the side pads in place unless rotted or mildewed. If they must be replaced, your kit dealer sells them, too. Leave the old pad on one side while installing the new one opposite, to maintain original spacing of bows in the top frame.

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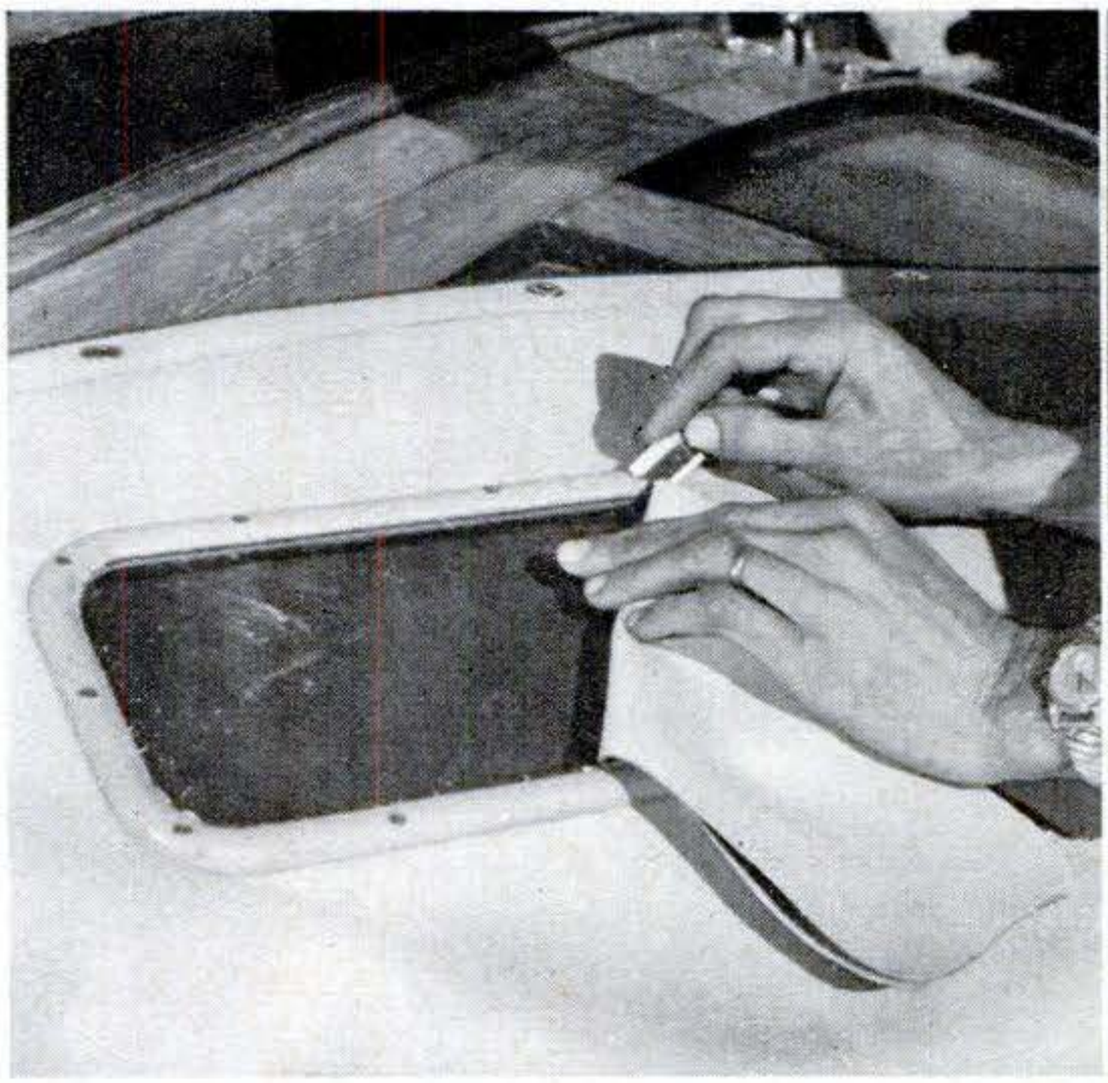
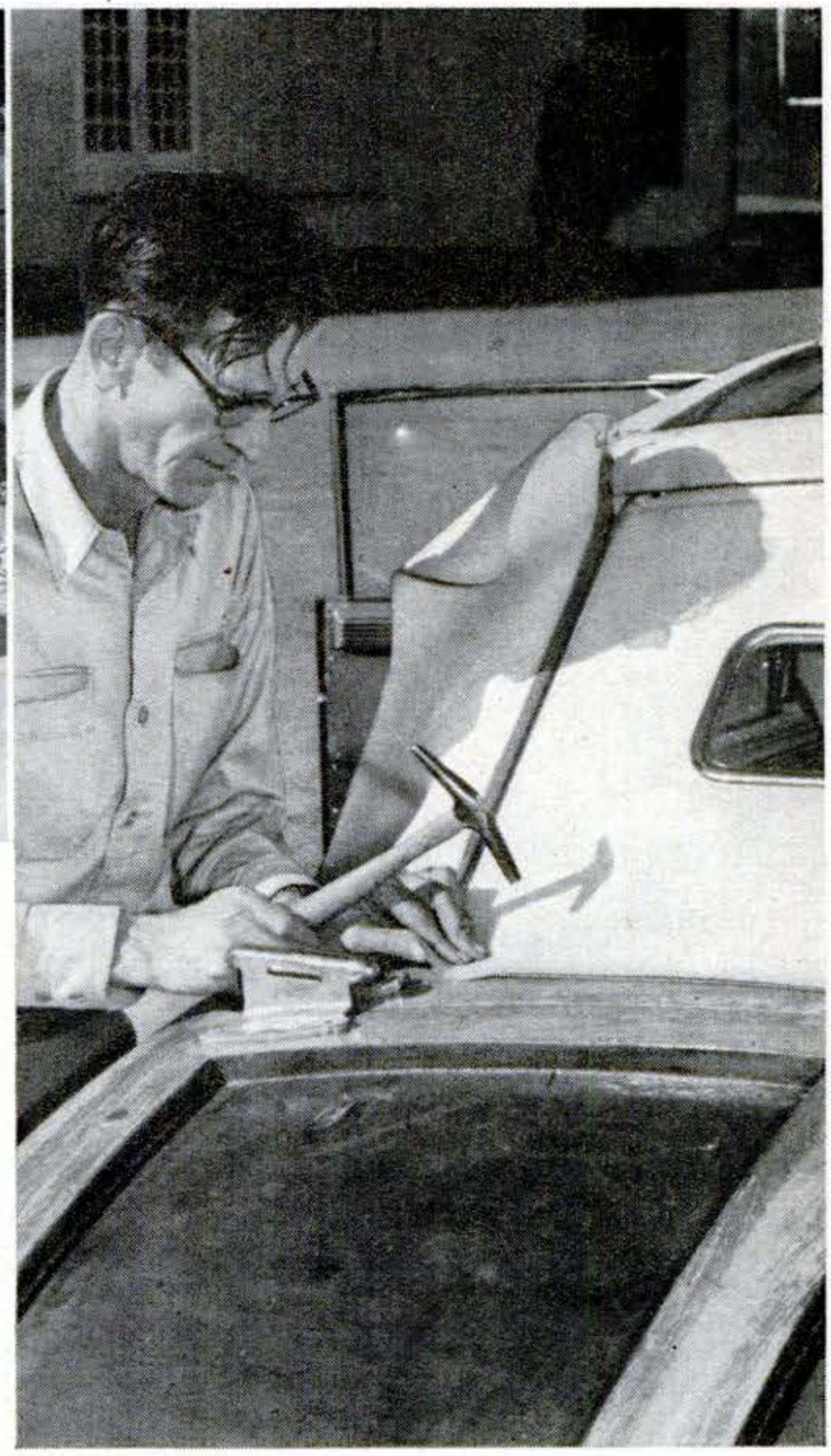
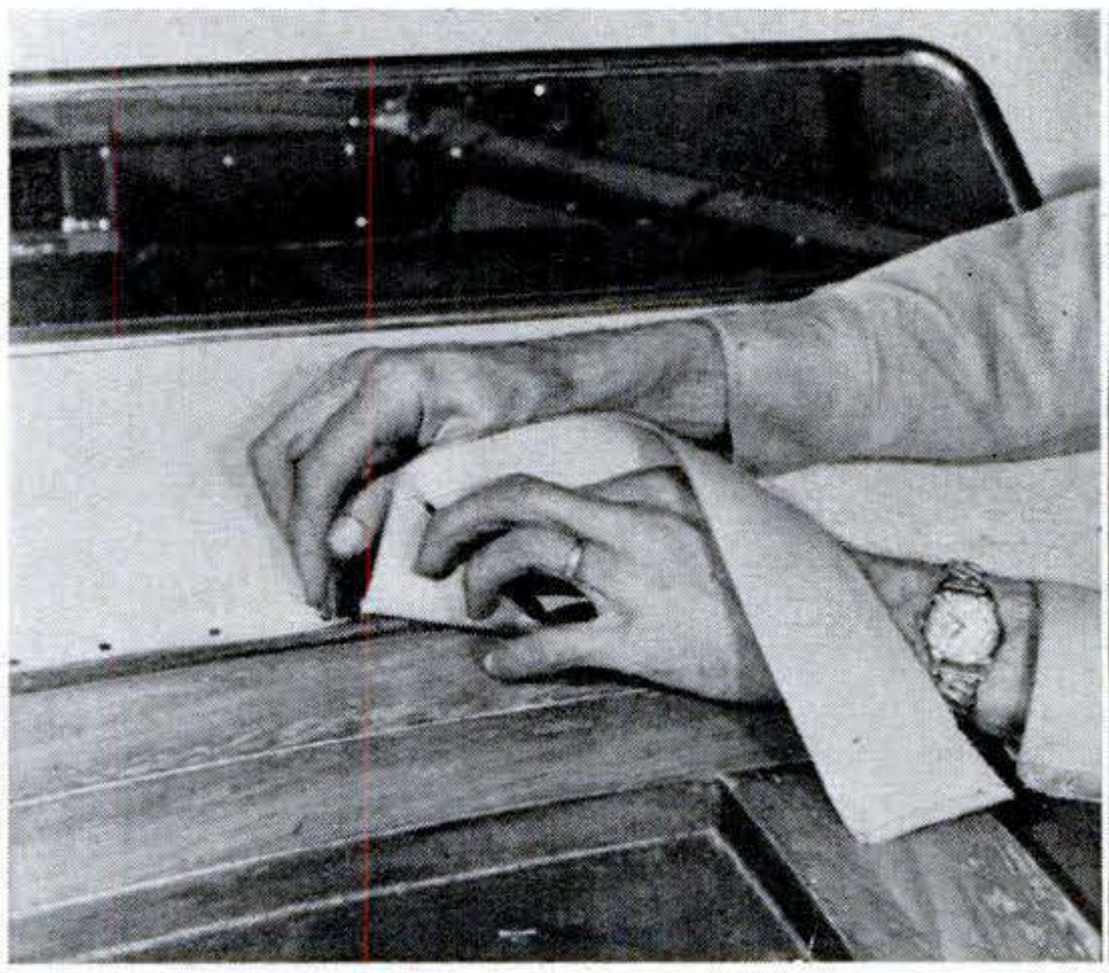
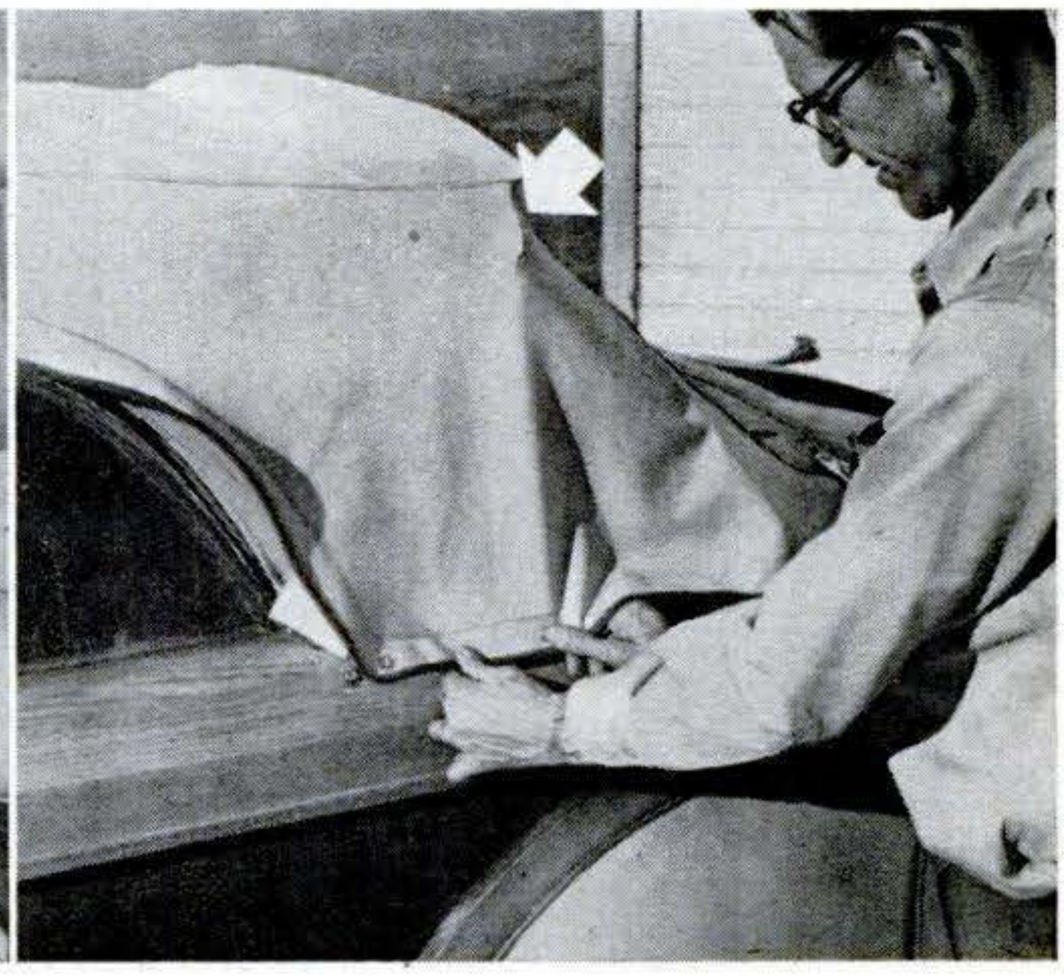




6 Set old window in new rear flap as first step in preparing new top for installation. Get its position from the old piece, or follow the marks usually found on kit material. Trim excess fabric with a razor blade after framing the glass. Skip this step if you've ordered a full-width plastic flap with your retopping kit.

7 Snap the flap in place on original fastenings under the rear bow. Line up the center with mark previously made on body and tack the bottom in place, working outward from the center. The small piece held on each side of the flap by zipper is tacked at top and bottom to support flap and seal out drafts.





8 Trim off excess material along the flap bottom with a razor blade, cutting close to the tacks so the new welt will cover tacks and edge of fabric. Use tacks generously, spacing them about an inch apart to prevent slack spots and wrinkles later when the fabric is tight.

9 Spread new top over bows, then fasten the side snaps to original fastenings on side of body. Adjust the top so both sides are smooth and top is even across rear bow. Fit the sides around curve to meet rear flap by cutting (arrow) until fabric curves smoothly.

Please turn the page for more retopping photos.

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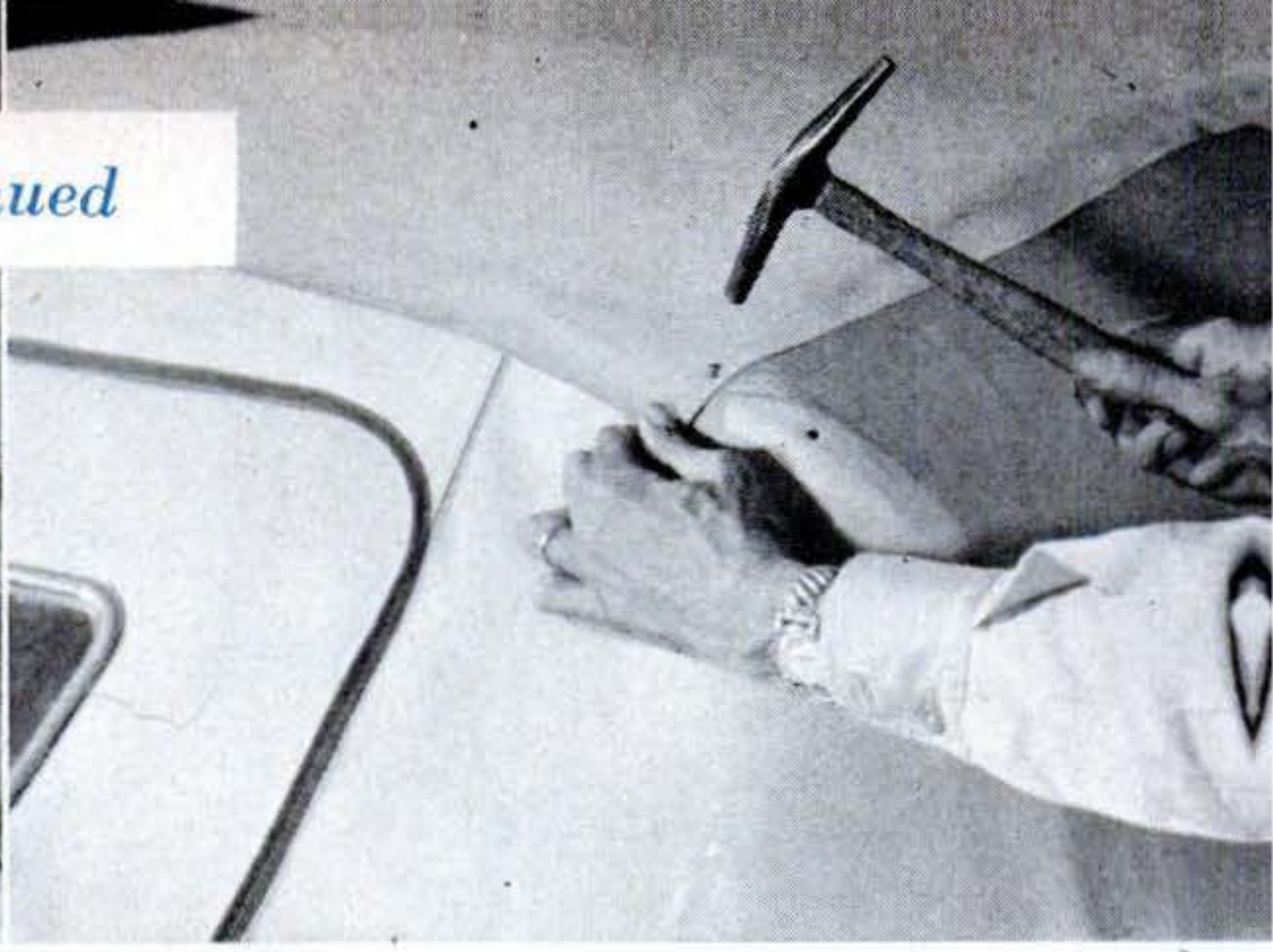

10 **Tack narrow rain flap** across the rear bow so that it lies over the rear-window flap to keep rain from blowing in. Start tacking at the center and work out to sides, driving tacks only part way in until you see that the flap will be straight. Pull out and reset tacks if necessary.

11 **Tack main top panel** over rain flap on the rear bow. This panel is stitched to sides from front to back, but several inches at rear are left unstitched for adjusting fit. Drive tacks in straight line and trim fabric close to them for easy and neat covering with welt.

12 **Now go to front** and pull top smooth for tacking forward edge. Don't stretch the fabric too tight—a few wrinkles will shrink out later. Align seam ends (arrow) with marks made on body before removing old top. They should be equidistant from windshield center.

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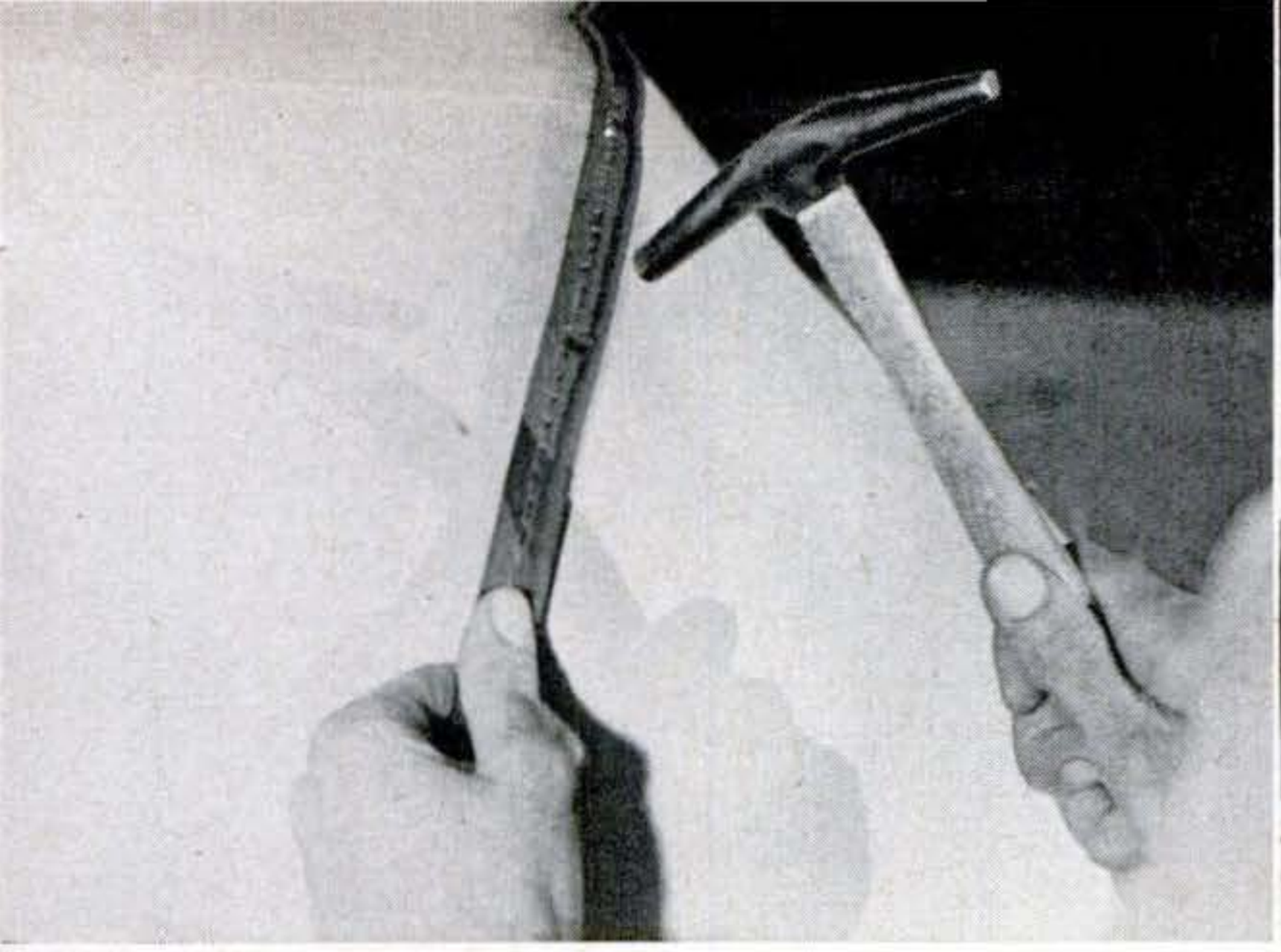
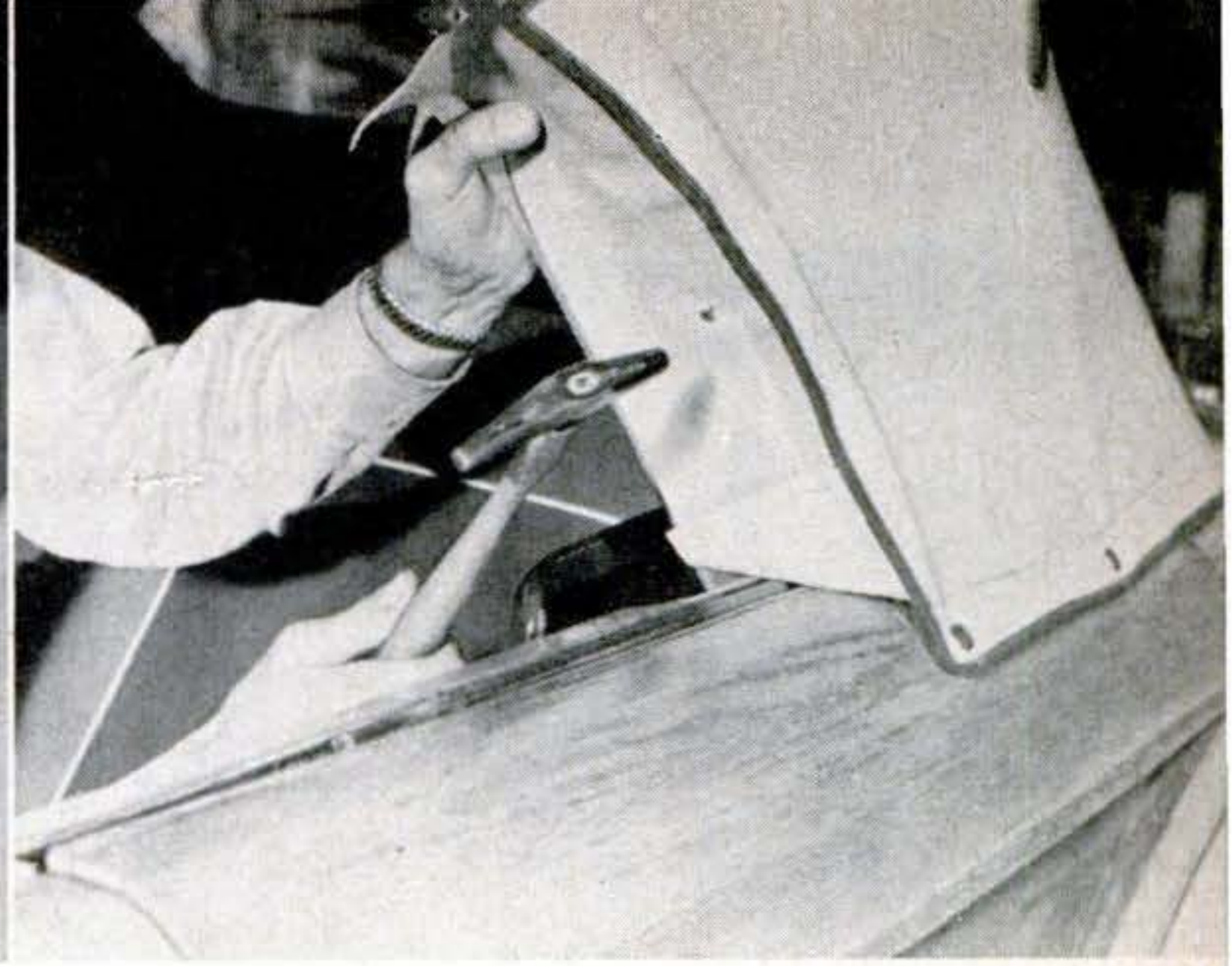
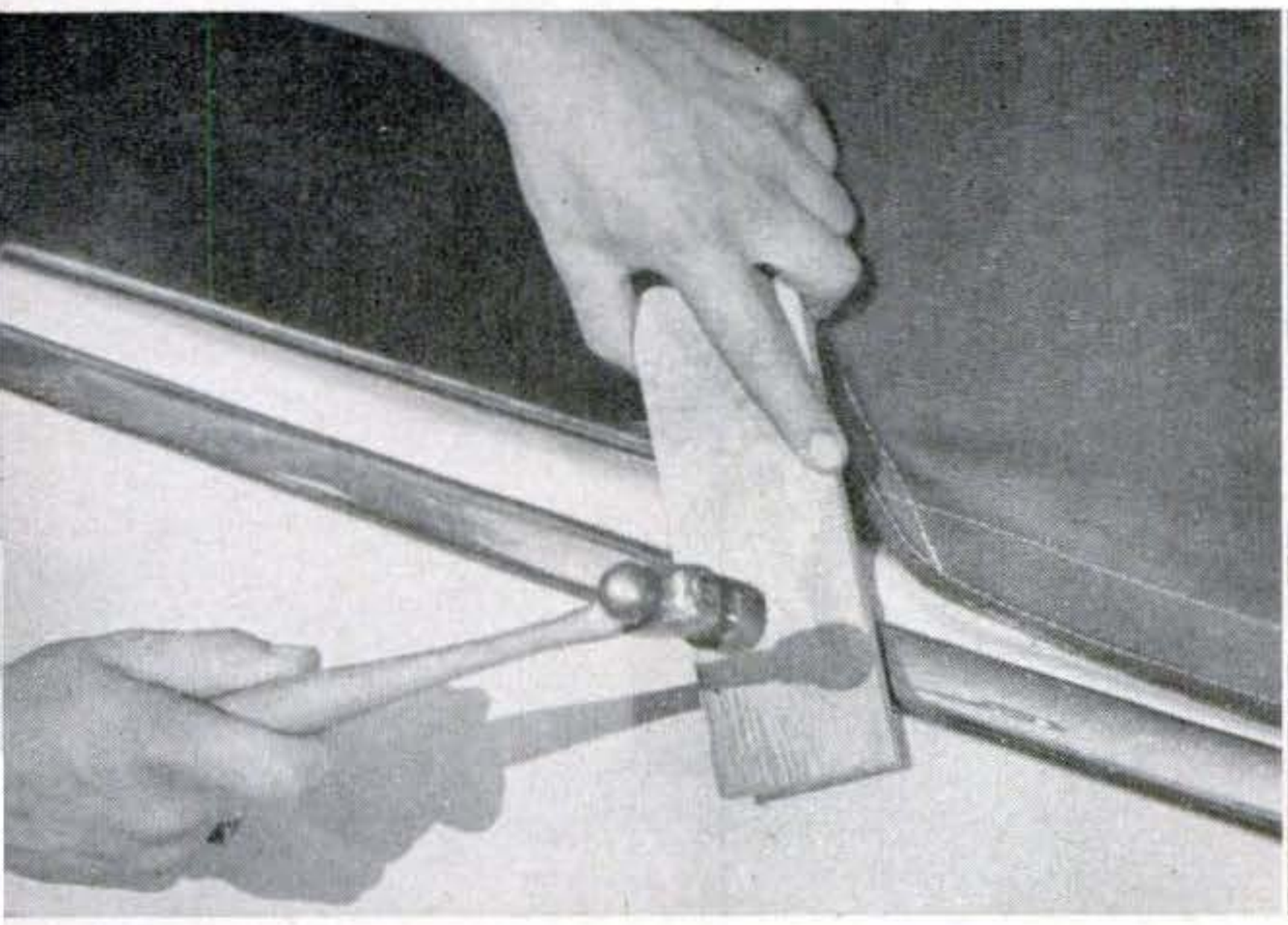


13 **Look the job over** at this point and pull a tack here and there if necessary to get a perfect fit. Then drive all tacks home and attach welt across rear bow to cover tacks and cuts made earlier when fitting sides. Welt folds over itself to hide the tack heads.



14 **Tack or cement side flaps** to the rear quarter frame on each side. These flaps pull top smooth at sides, so adjust carefully before tacking. Screw retainers for window gaskets over flaps and trim fabric even with inside edge. Snap rubber gasket in place.



15 **Replace trim strip** or welt where top joins body. Screw strip in original position over fabric at rear. Then snap the side sections to the backing strips with smart blows of a hammer against a block of wood to keep from denting the metal. Now only the front is left.

16 **Complete the job** by tacking down front of top at corners. Fit fabric to the corners by slashing and folding it over itself. Tack and cover with welt across entire front edge. Screw decorative metal points over the welt ends—and the job is finished, ready for use. **END**

Care Extends Life of Top

DUST and dirt can wear a top thin in spots by abrasive action. Vacuum it occasionally and wash it when it's dirty. Clear waterproofing solutions can be brushed onto a leaky top, and there are dyes and canvas paints that will freshen up faded fabric. Best way to get an even application is to spray it on, but circular sweeps with a scrub brush will minimize lap marks. Small rips or worn spots can be patched with a press-on tape made for convertible tops. Back up the spot with a board and stick the patch on with a hot iron.

More Power to Your Shop:

How to Run Many Tools With One Motor

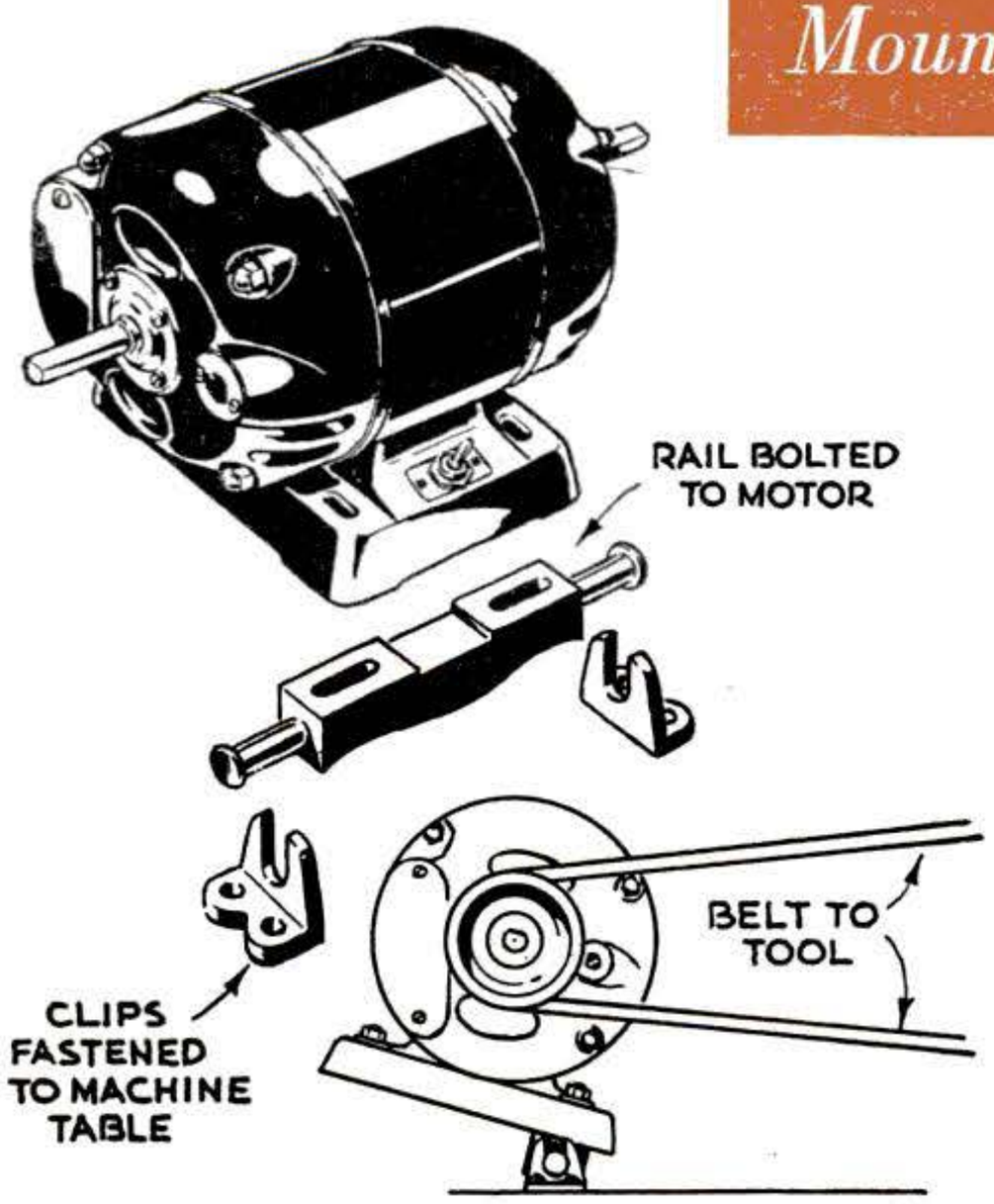
Bulb-snatching may be naughty, but motor-snatching isn't. It is a fine way to stretch a buck when a power-tool workshop is growing.

By Harry Walton

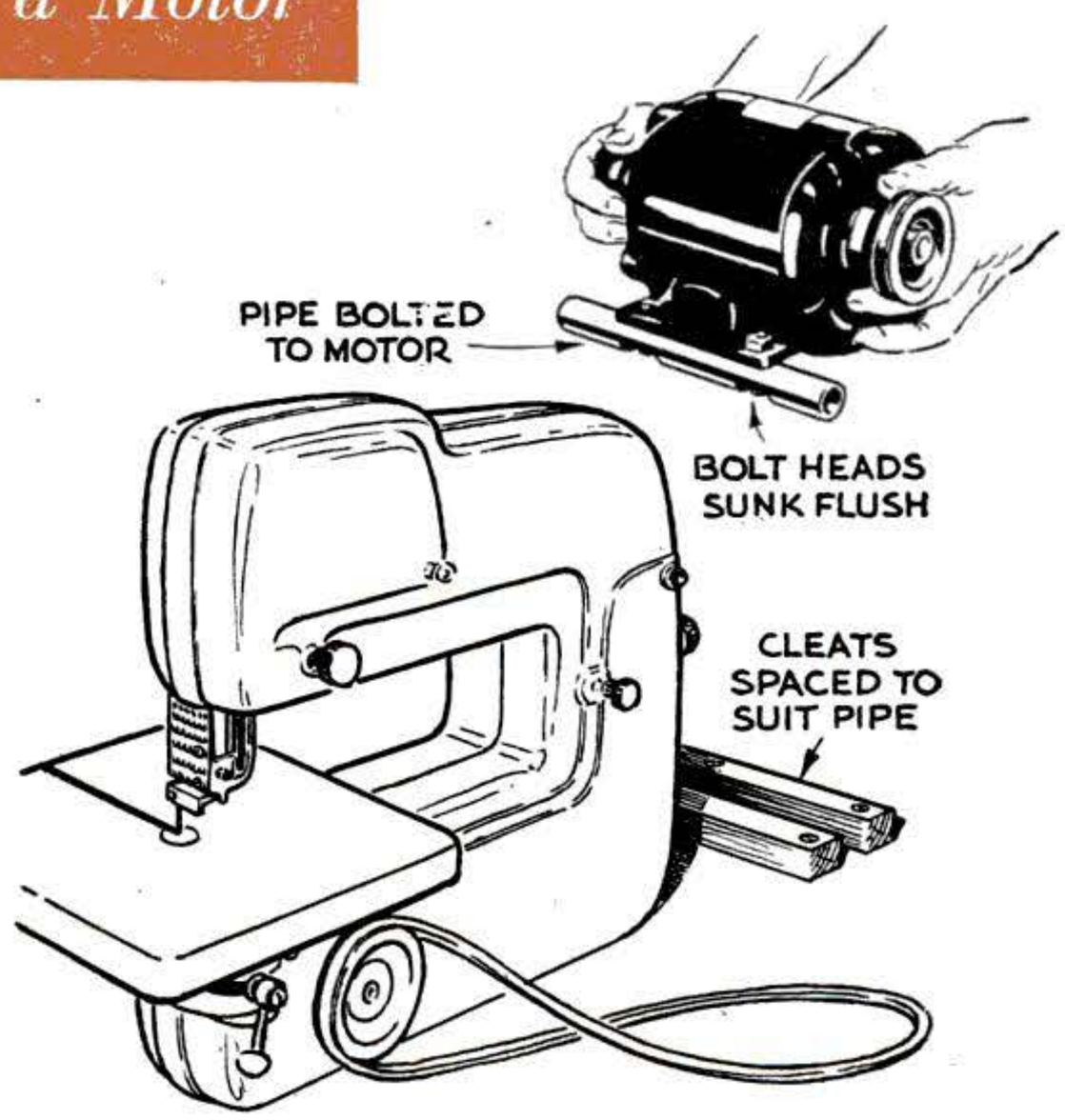
SOMETIMES a workshop budget will stretch to buy a new power tool but threaten to snap under the price of an extra motor. Shifting a motor from tool to tool is one answer, and with the right setup a very practical one.

Here are installation dodges that make the change-over so quick and easy you won't be tempted to do without a machine rather than make the shift. Drop-in mounts let you

Three Ways to Mount a Motor



RAIL ON MOTOR and clips at each machine make it easy to lift power unit off one and drop it in driving position at another. These mounts can be bought ready-made. Overhanging motor weight keeps belt taut. Install so that motor tilt is well above the horizontal. If motor hangs almost flat, toggle action puts excessive strain on belt and bearings.



HOMEMADE MOUNT consists of a piece of pipe bolted to the motor base. This drops between a pair of cleats fastened near each machine in such a position that the motor tilts back away from it. A second pipe can be bolted to the other end of the base if the motor is to be turned end for end in some locations so that rotation can be reversed.

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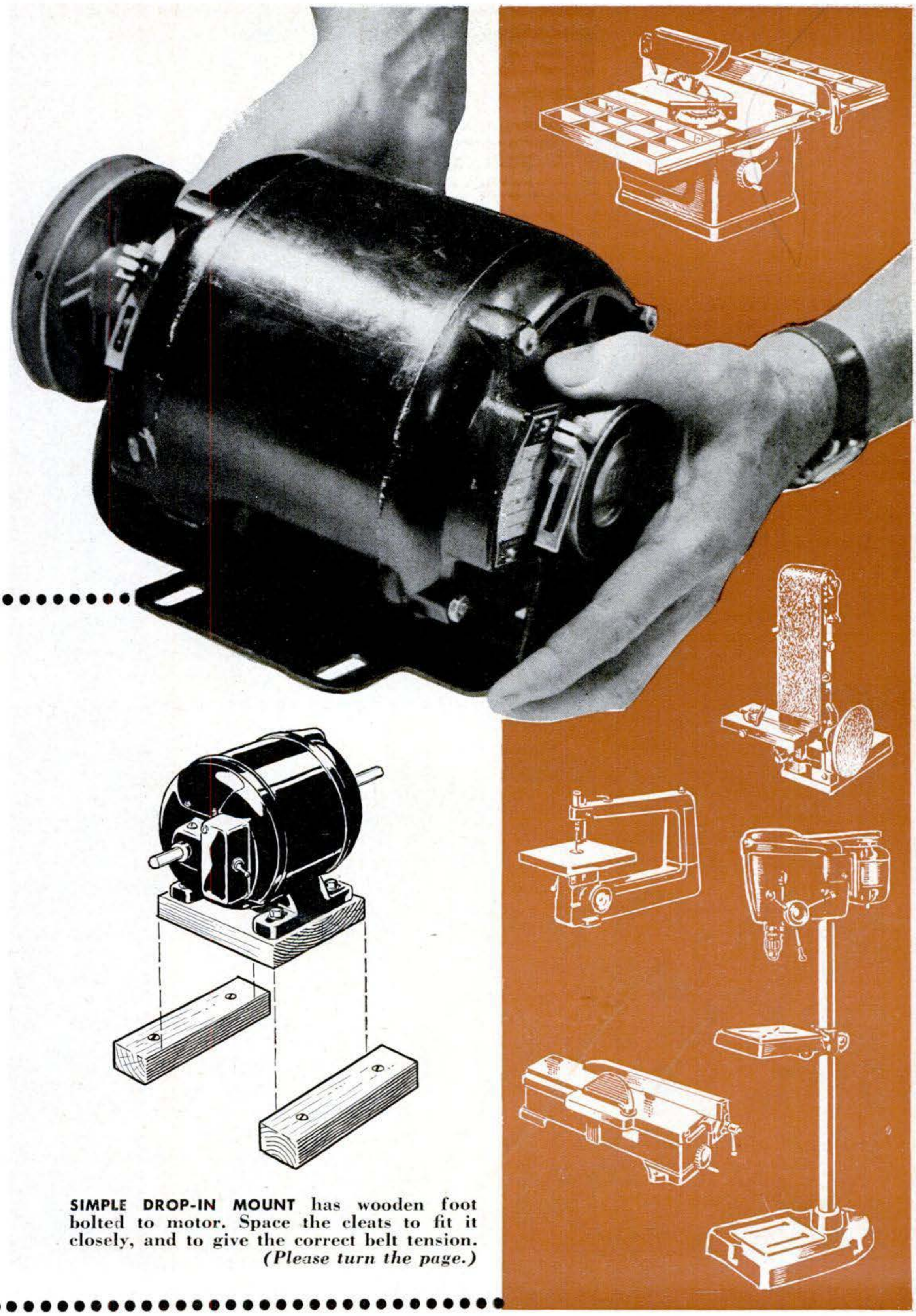

SIMPLE DROP-IN MOUNT has wooden foot bolted to motor. Space the cleats to fit it closely, and to give the correct belt tension.

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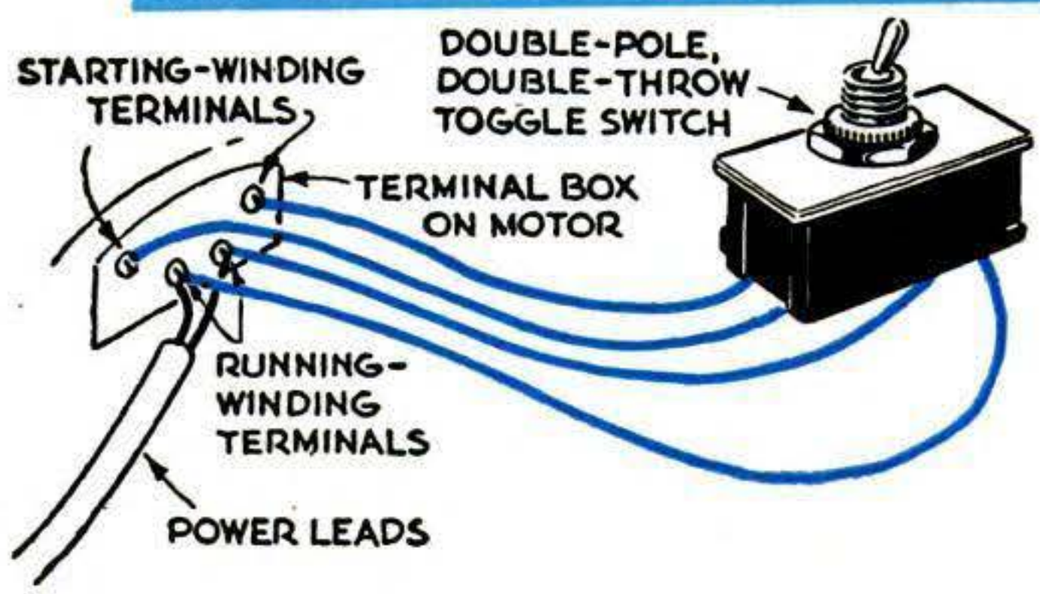
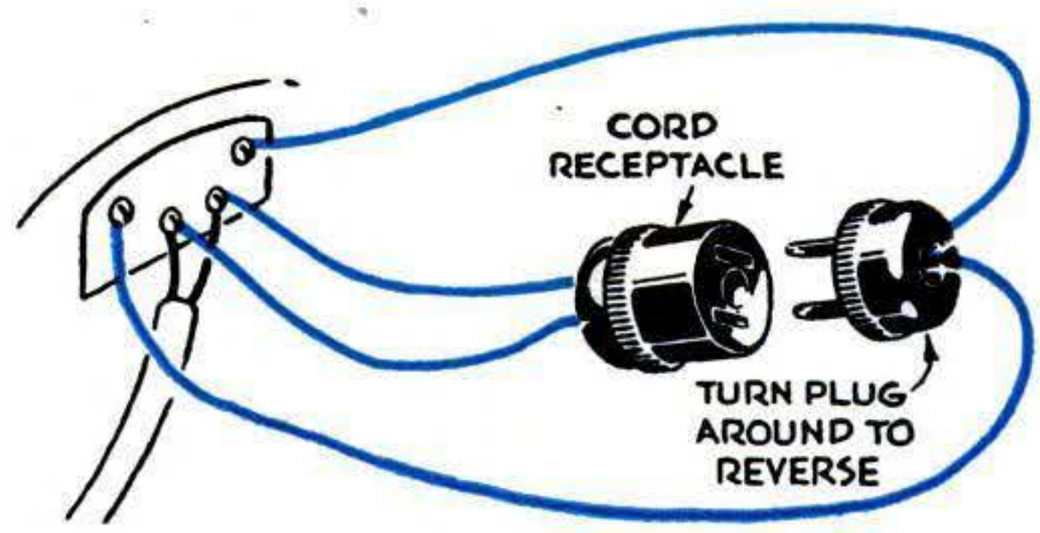
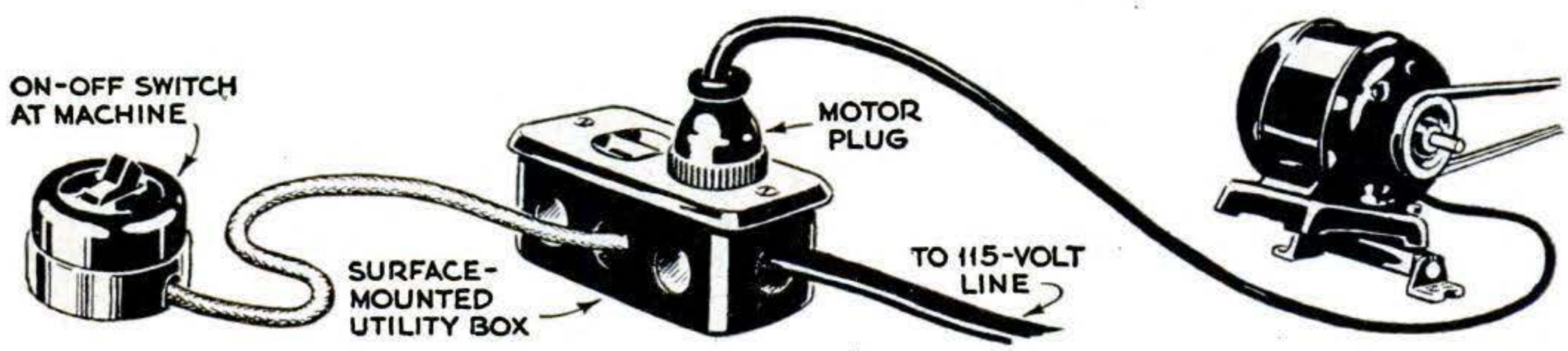
Wiring Rigs to Simplify Motor Control



MOTOR CAN BE REVERSED with a toggle switch wired like this. It should be a spring type with no center "off" position; a separate on-off switch should be wired into the power leads. Commercial reversing switches sold for power-tool motors include on-off function.

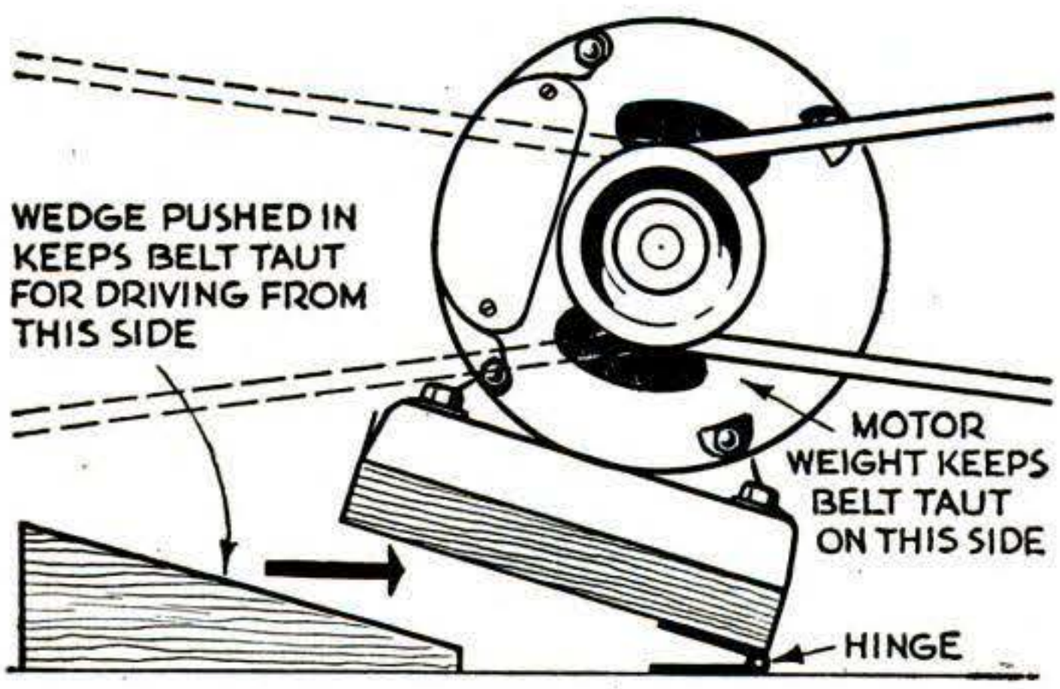


A PLUG-IN RECEPTACLE and a common plug can be used for reversing a motor as above. To change rotation, pull out the plug, turn it halfway around and reinsert it. Be sure to use a separate on-off switch. Never leave the plug out of the receptacle.



SWITCH AND RECEPTACLE permanently mounted at each machine provide handy power source and control of interchangeable motor. Motor is easier to shift because it requires only a short cord and plug of its own. It is also safer to have switch in a fixed position.

How One Motor Runs Two Power Tools



HINGED MOUNT allows a motor to run either of two machines at full power without drag of second one. Motor weight keeps belt taut for driving on hinge side as shown. To run second machine, motor is tilted up, belt is shifted, and a wedge is pushed under the free side. Change takes 20 seconds.

do it in seconds. The tilt feature facilitates putting on the belt—no need to force it over a pulley rim.

A two- or three-step motor pulley will give you a choice of drive ratios to suit various machines. Properly installed, the tilting mounts shown let a motor be shifted sideways, aligning any pulley step.

When motor rotation must be reversed, you can sometimes simply turn the motor end for end. Where this won't do because the motor would overhang its support or interfere with other equipment, the day may be saved if the shaft is double-ended. Simply put a pulley on the other shaft end.

But sometimes a motor must be reversed electrically. To do this, the relationship between the starting and running windings of an AC motor must be reversed. The instructions with a new motor will usually identify the four winding leads and show how to reconnect them to change rotation. The switch can be mounted on the motor, possibly on the terminal-box plate. If in doubt, have an electrician do the job. END

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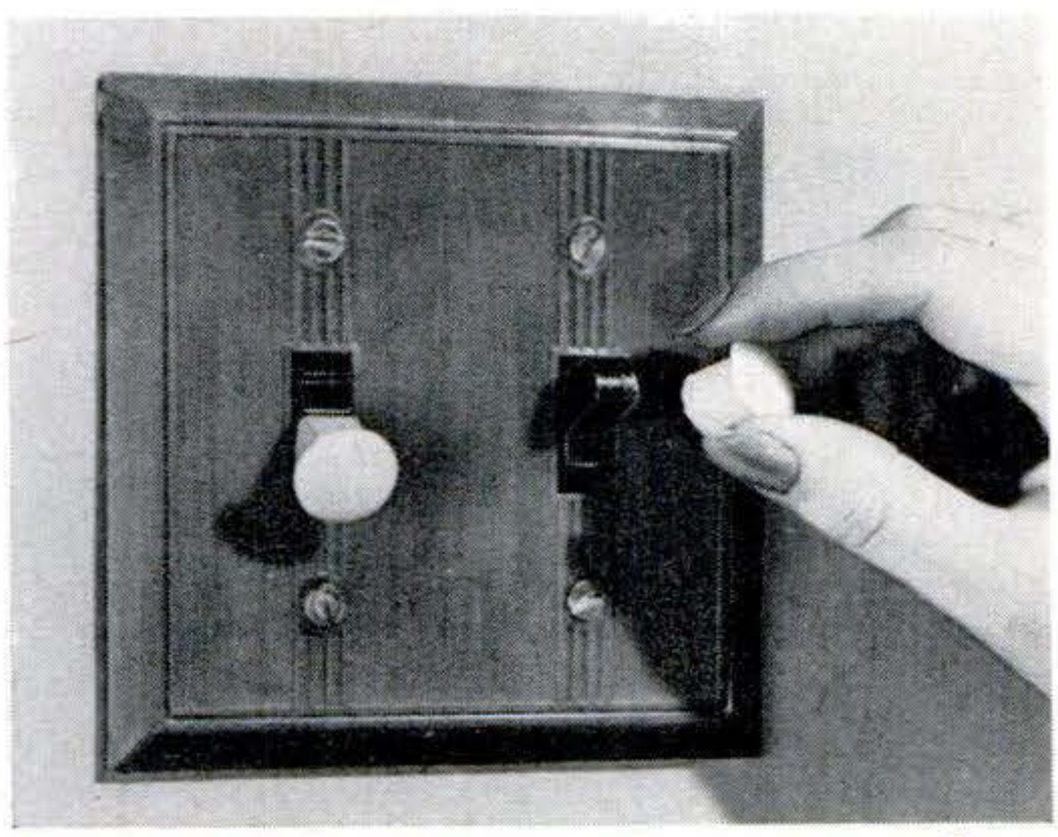
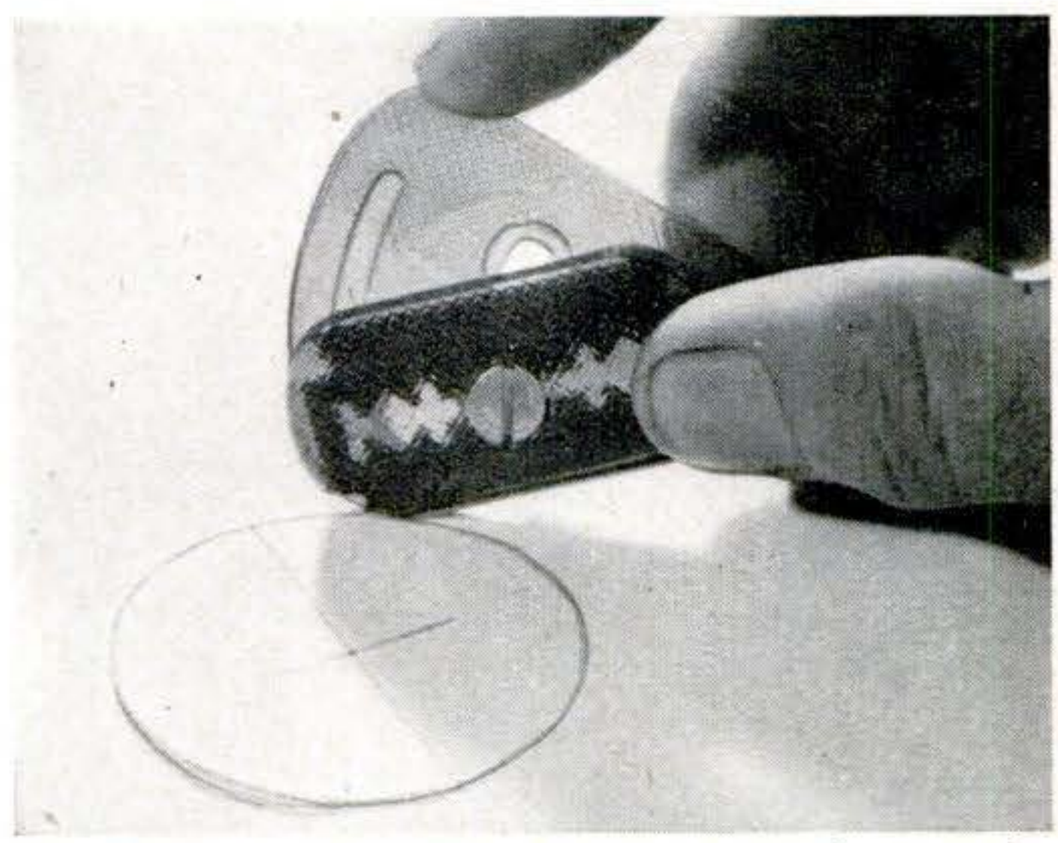
New for the Handy Man

1. Rig Holds Storm Windows. With this extra "hand," heavy storm windows and screens can be put up or taken down quickly. The lightweight aluminum frame rests against the house and supports the outer end of the window or screen, making sure that it can't slip or be blown from your hands.

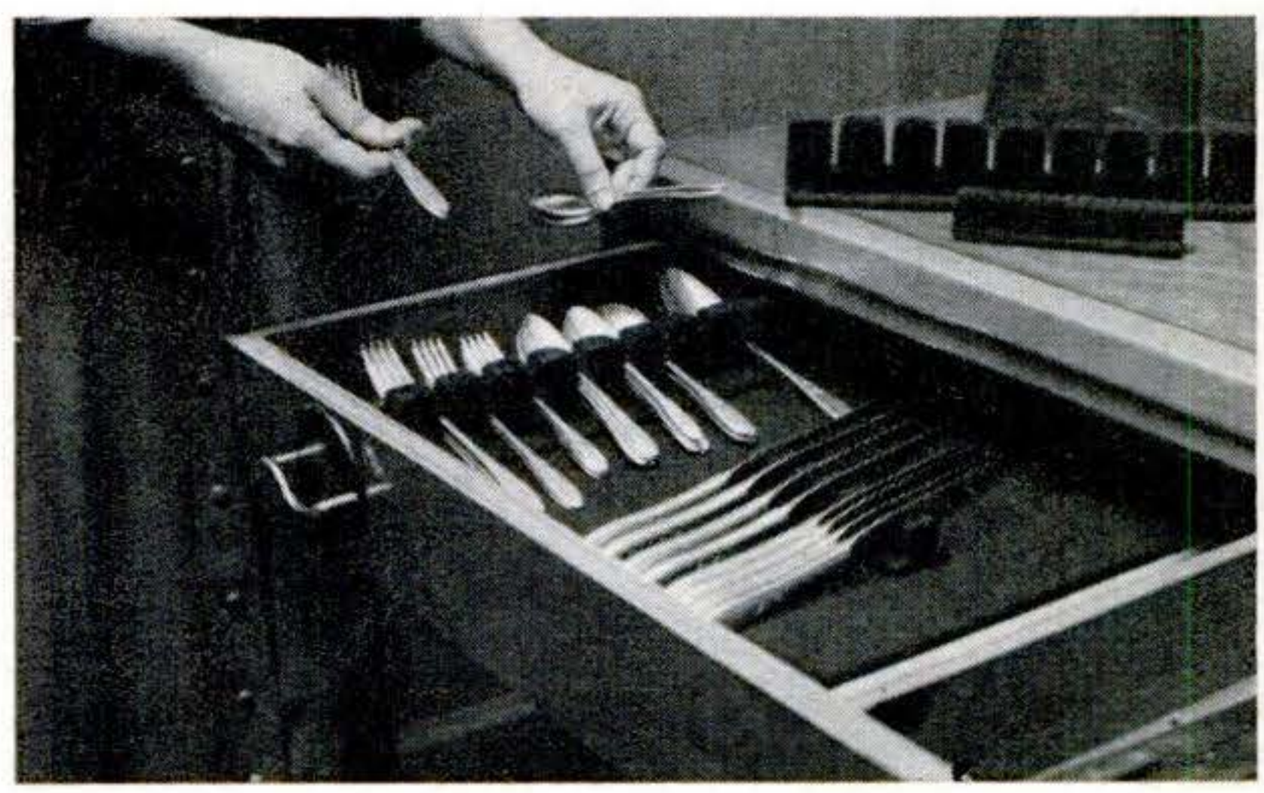


2. Switches Glow in Dark. Press these caps over your light switches and you'll have no trouble finding them at night. The plastic caps contain a luminous compound.



3. Blade Holder Adjusts for Depth. This plastic scraper is a knife, too. It locks a razor blade so that it sticks out just enough to make the depth of cut desired.

4. Kit Makes Silver Drawer. Any ordinary drawer can be quickly converted to a tarnish-proof compartment for silverware. A kit to do the job includes a chemically treated cloth for the bottom of the drawer, a cover cloth and several slotted silver holders that are arranged as desired and screwed in place. Four kits are available containing different-size cloths and from two to six holders, to accommodate from 108 to 420 pieces.



Please turn the page for more handy-man news.

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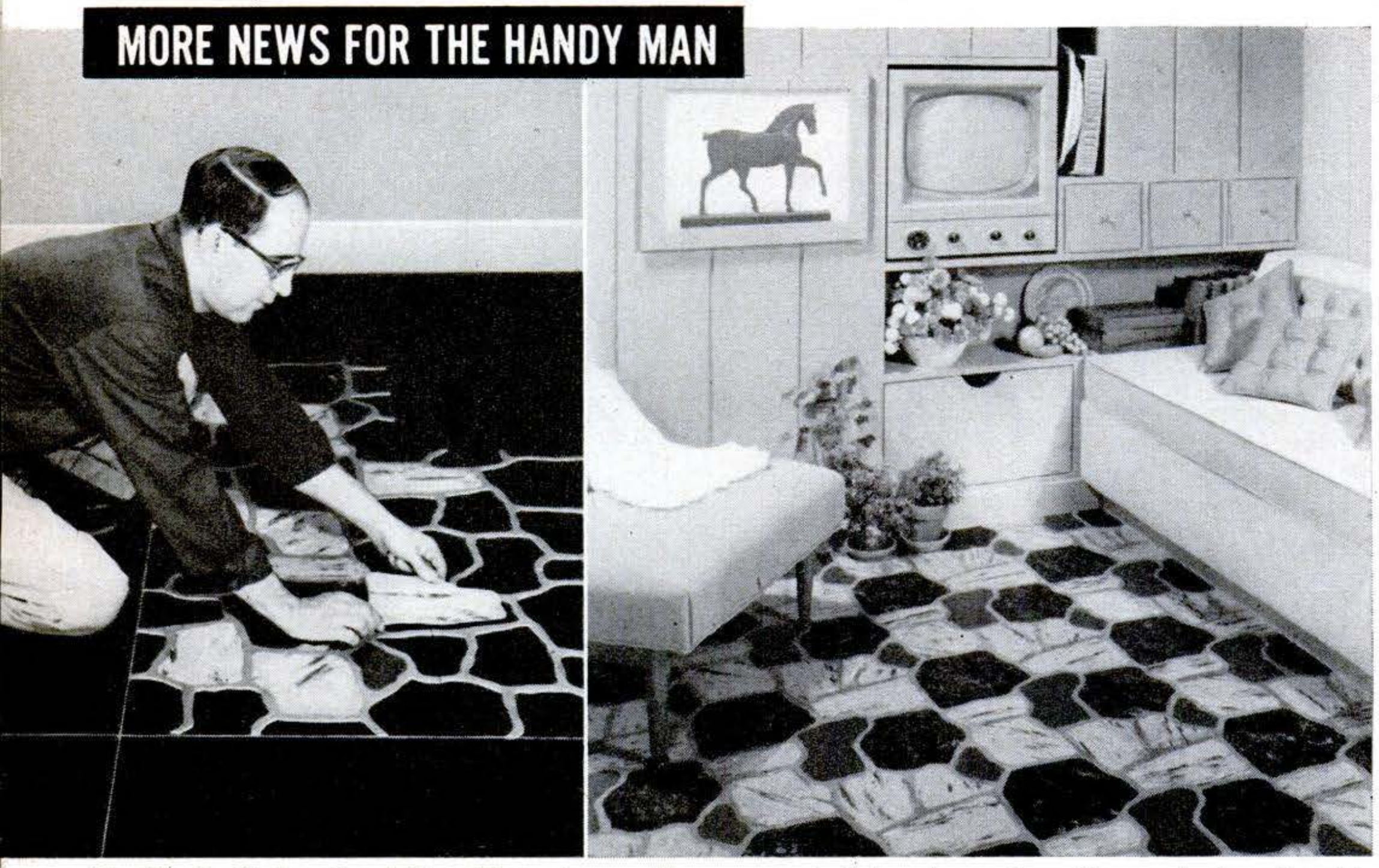
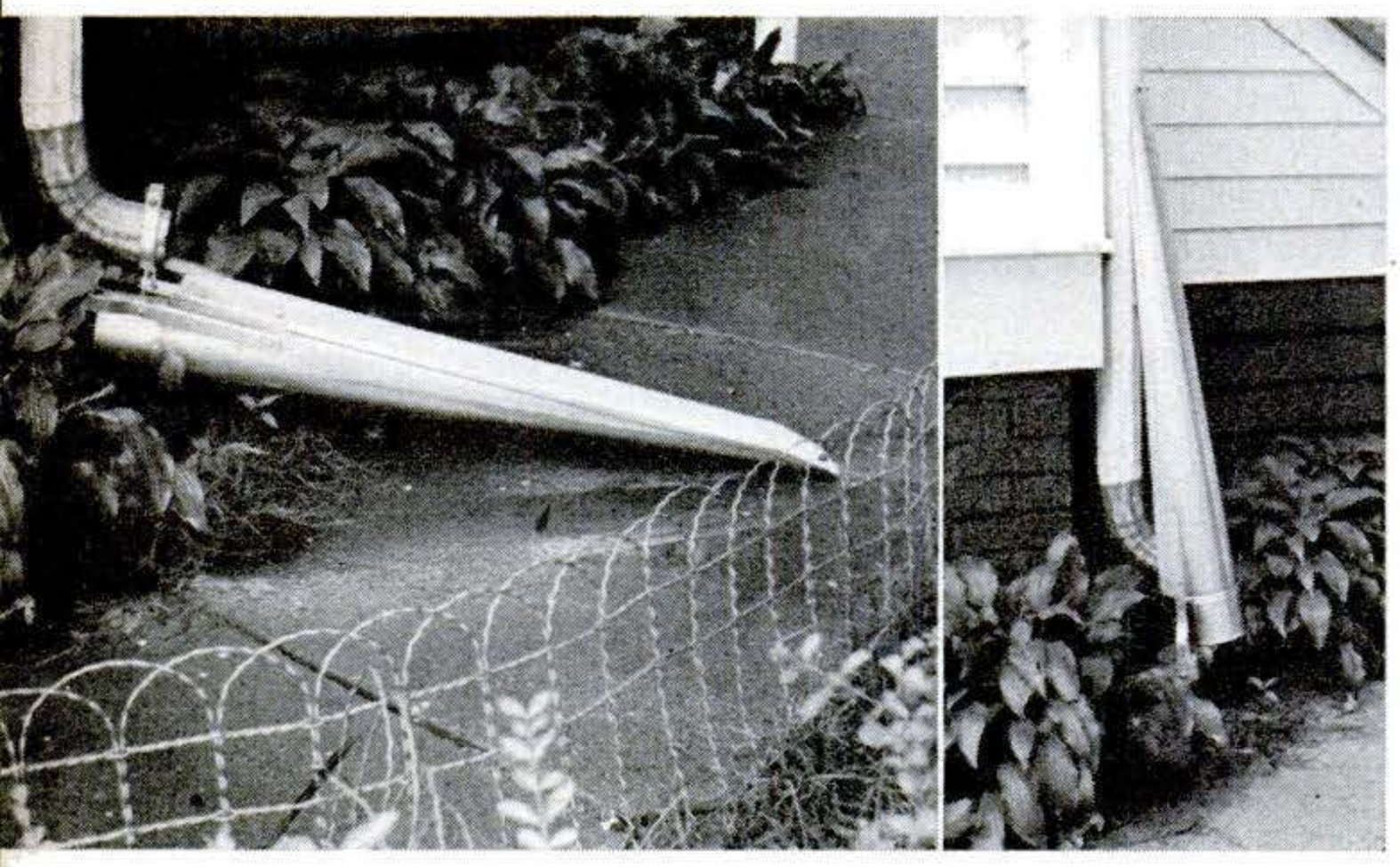
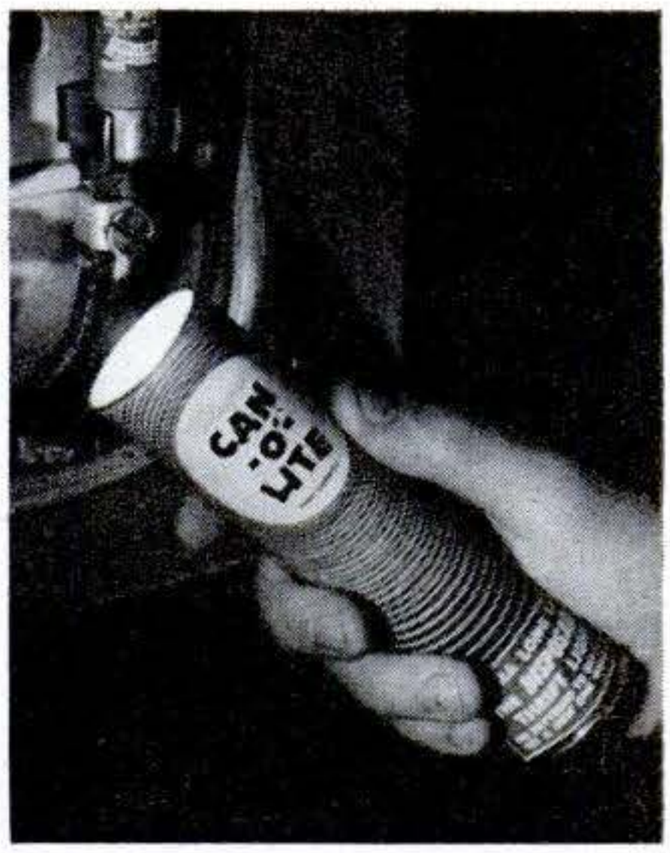
MORE NEWS FOR THE HANDY MAN



5. Asphalt Looks Like Flagstone. You can now put down an asphalt-tile floor that has the irregular, random pattern of flagstone. A gray background grid is first cemented in place, then the varicolored, odd-shaped tiles are fitted into the spaces like pieces in a puzzle. Three different color combinations are available.

6. Rain Works Drainspout. This extension arm for a drainspout helps carry water away from a house when it rains, then automatically folds up when the rain stops, keeping paths, patios and play areas free from obstruction. Delicately balanced by counterweights, the spout is forced down by the flow of rain water, then pulled back up by the weights when the flow stops.





7. Flashlight Is Disposable. When this inexpensive flashlight burns out, you just throw it away and buy a new one. Essentially one big battery with a bulb on top, it will burn for five minutes a day for approximately 130 days.

Further information on the products described on this and the preceding page can be obtained from: 1. Pre-Tested Products Co., 17 Guilford Ave., Baltimore 2, Md.; 2. Sani-Speed Mfg. Co., 1364 E. 47 St., Cleveland 3, Ohio; 3. Ambi Corp., Box 39, Whitestone 57, N.Y.; 4. California Ways, 261 B St., San Mateo, Calif.; 5. Armstrong Cork Co., Lancaster, Pa.; 6. Crawford Co., Rock Island, Ill.; 7. Standard Supply Co., Box 281, Ashland, Ohio.

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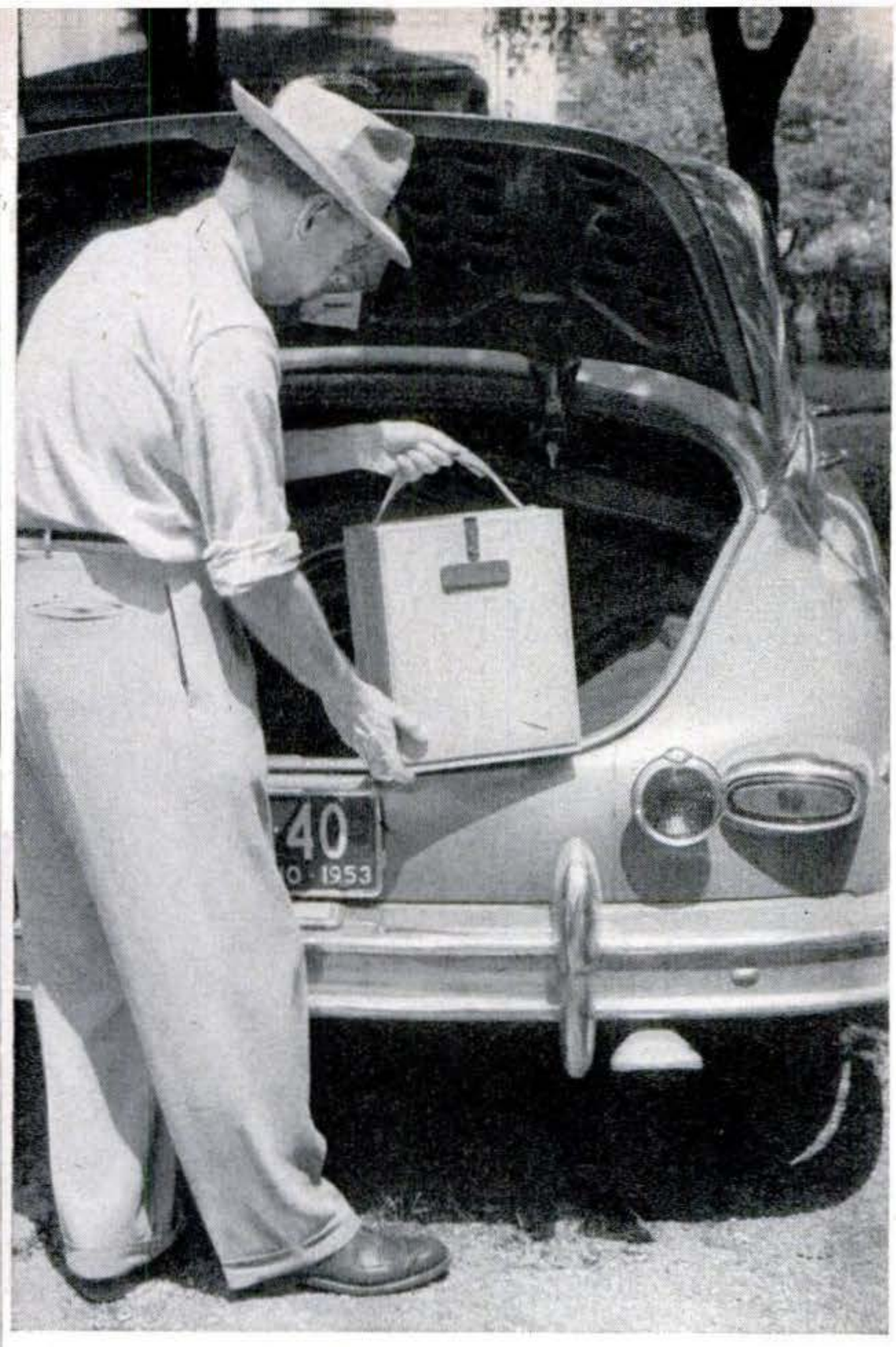
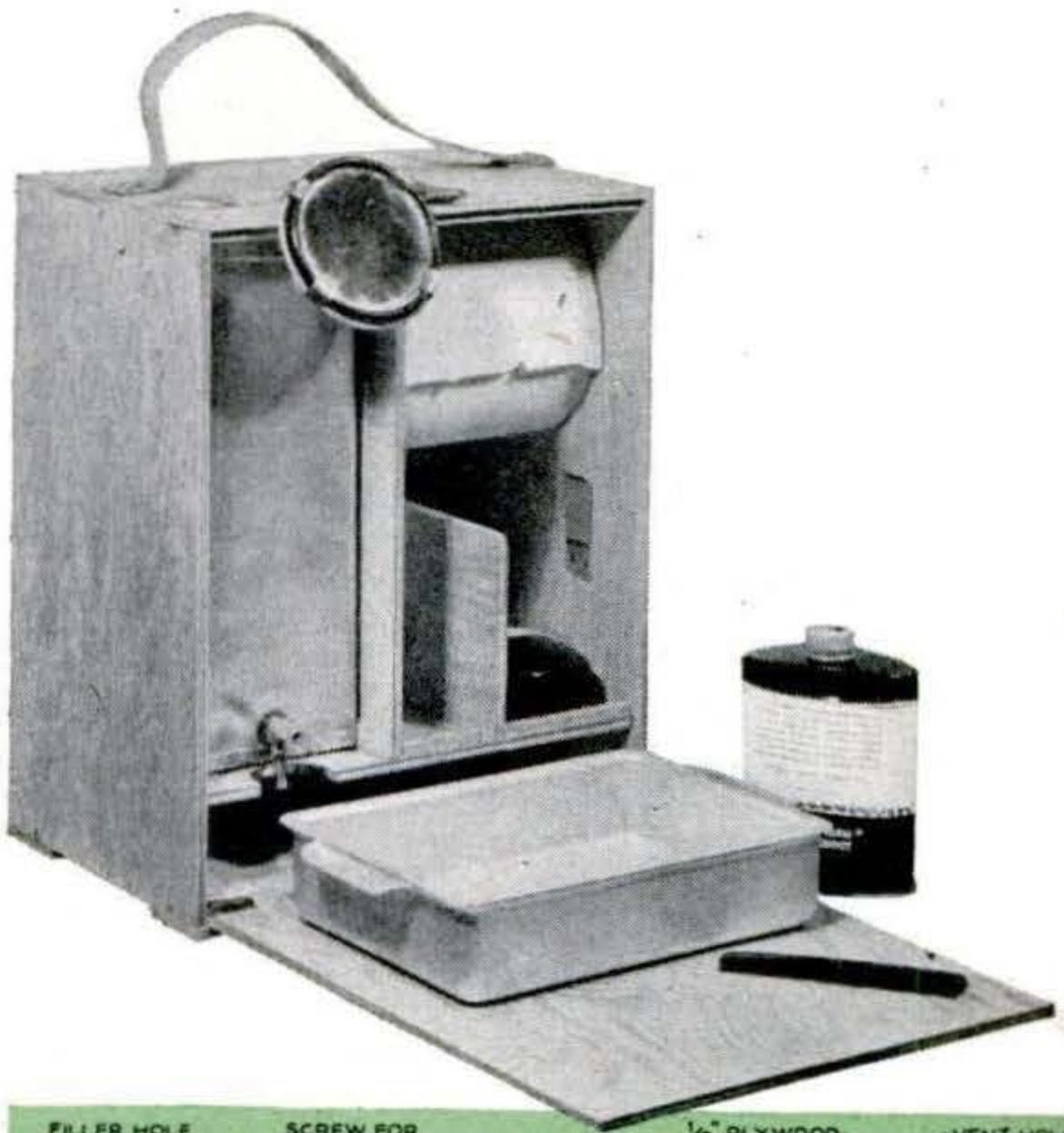


How to Build A Roadside Wash-Up Kit

Carried in the trunk of your car, it will enable you to come away clean from the messiest jobs.

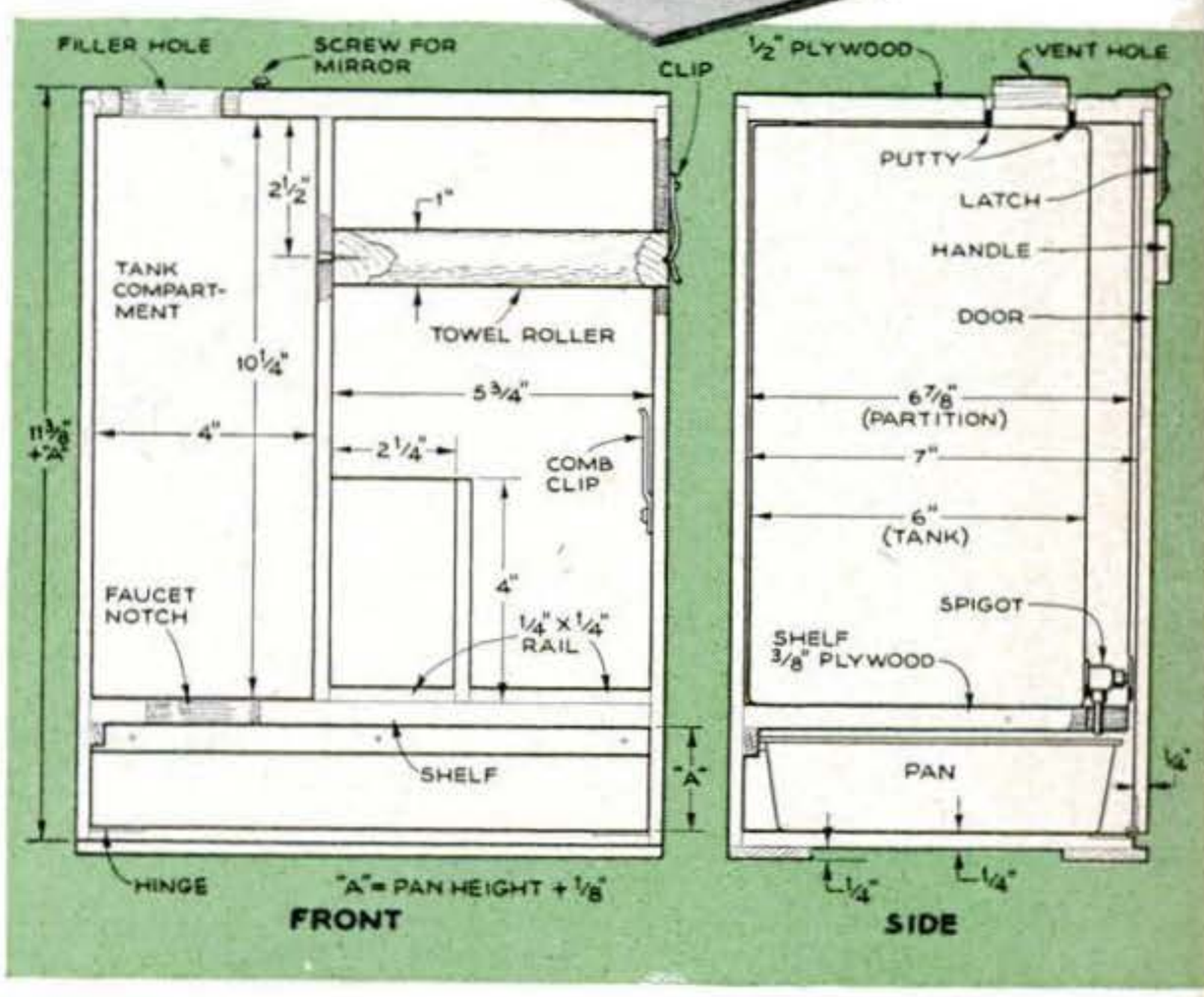


By Walter E. Burton

UNTIL washrooms are built into automobiles, this little clean-up unit will help you to tidy up after a dirty tire-changing or car-fixing job. It also will supply the soap and water for sticky fingers after a picnic and serve as an emergency lavatory during camping trips.

The kit is contained in a plywood box measuring approximately 7½″ by 10½″ by 13½″ on the outside. Its contents include a one-gallon water tank with spigot, a 2″-deep aluminum wash tray, cake of soap in a covered box, can of grease-solvent powder, comb, mirror, paper-towel roll and washcloth. And there's still room for other items you may want to add.

The important thing about the tank is that it must be rustproof, which means that



COMPACT DESIGN is shown at right. As water may spill when the tray is moved, waterproof plastic sheets should be used to cover the inside of the door and bottom of tray section.

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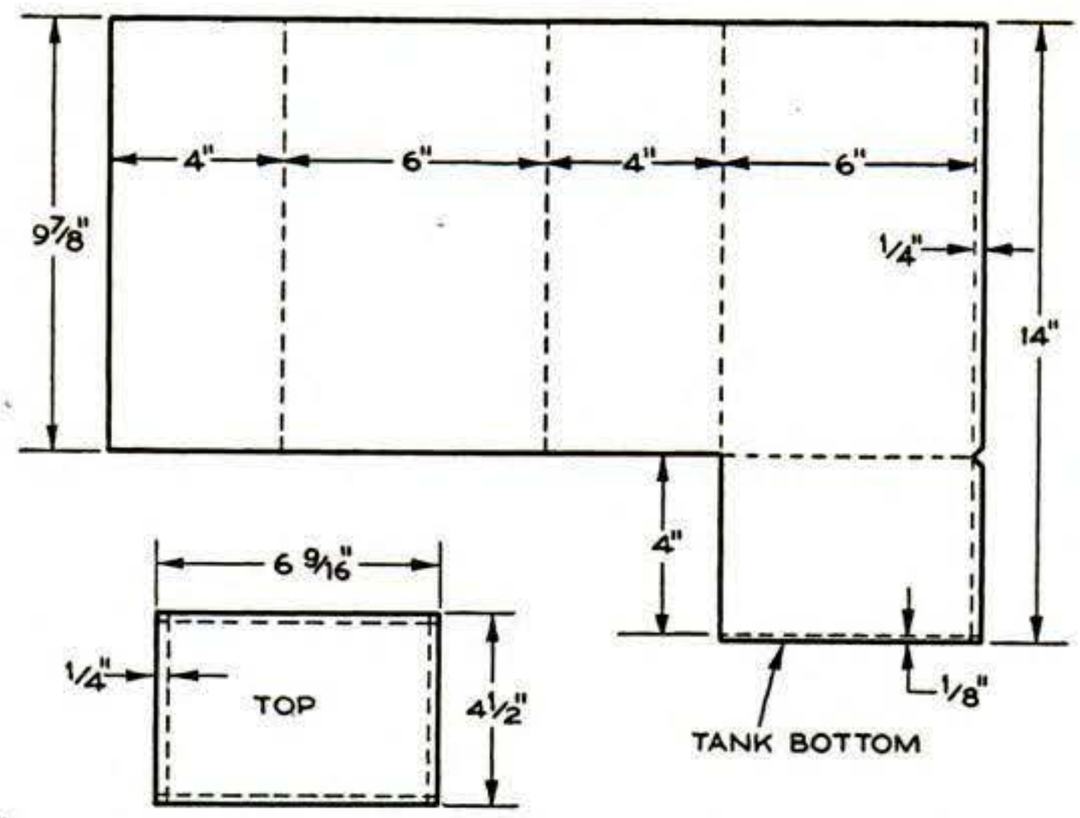


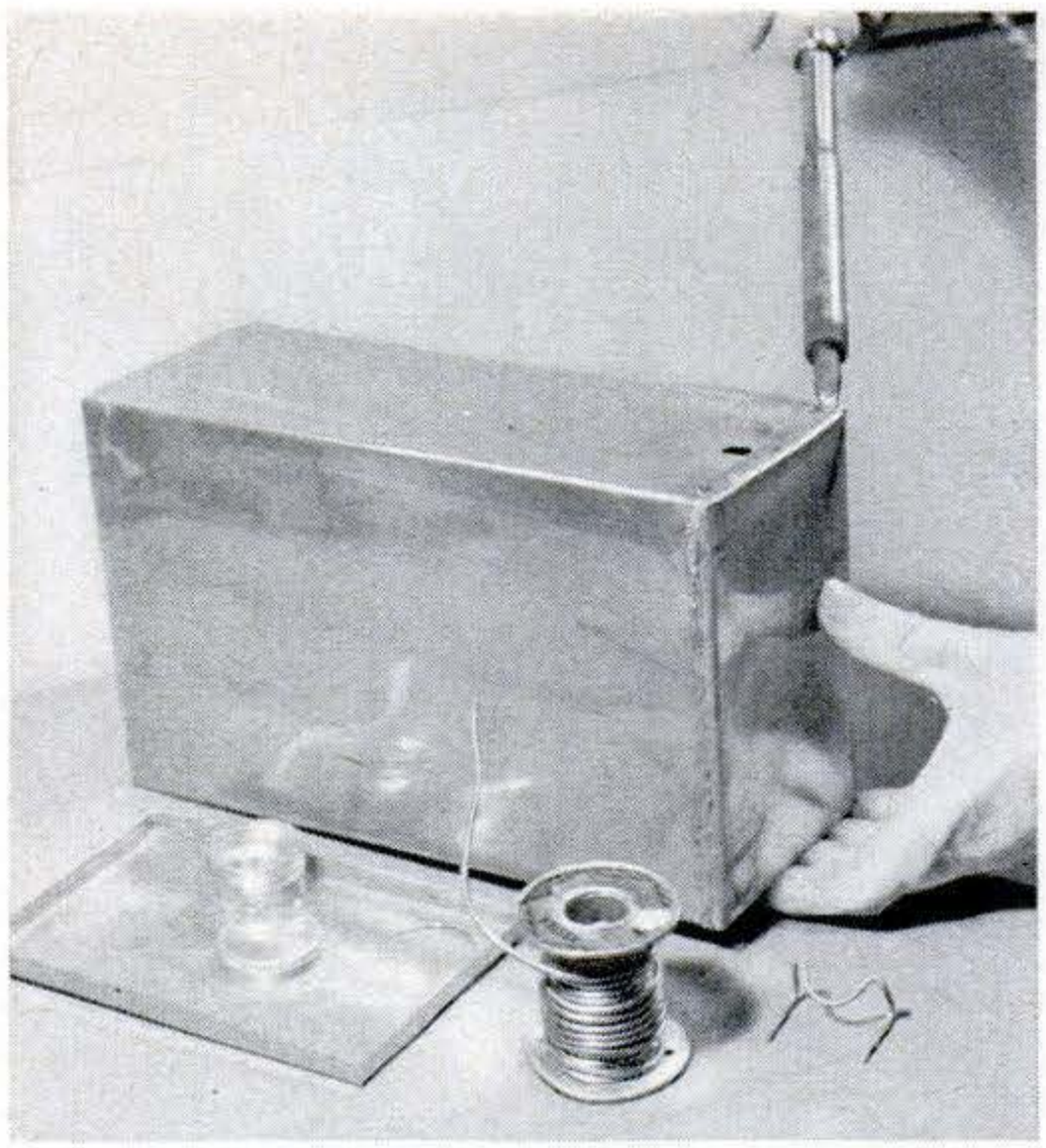
SHEET ZINC sold for chimney flashing can be used to make rustproof tank. In bending, allow for the thickness of the metal. When soldering seams, use a noncorroding flux; coating them with waterproof lacquer or other sealant is recommended. Wash all soldering flux from the tank after completion.

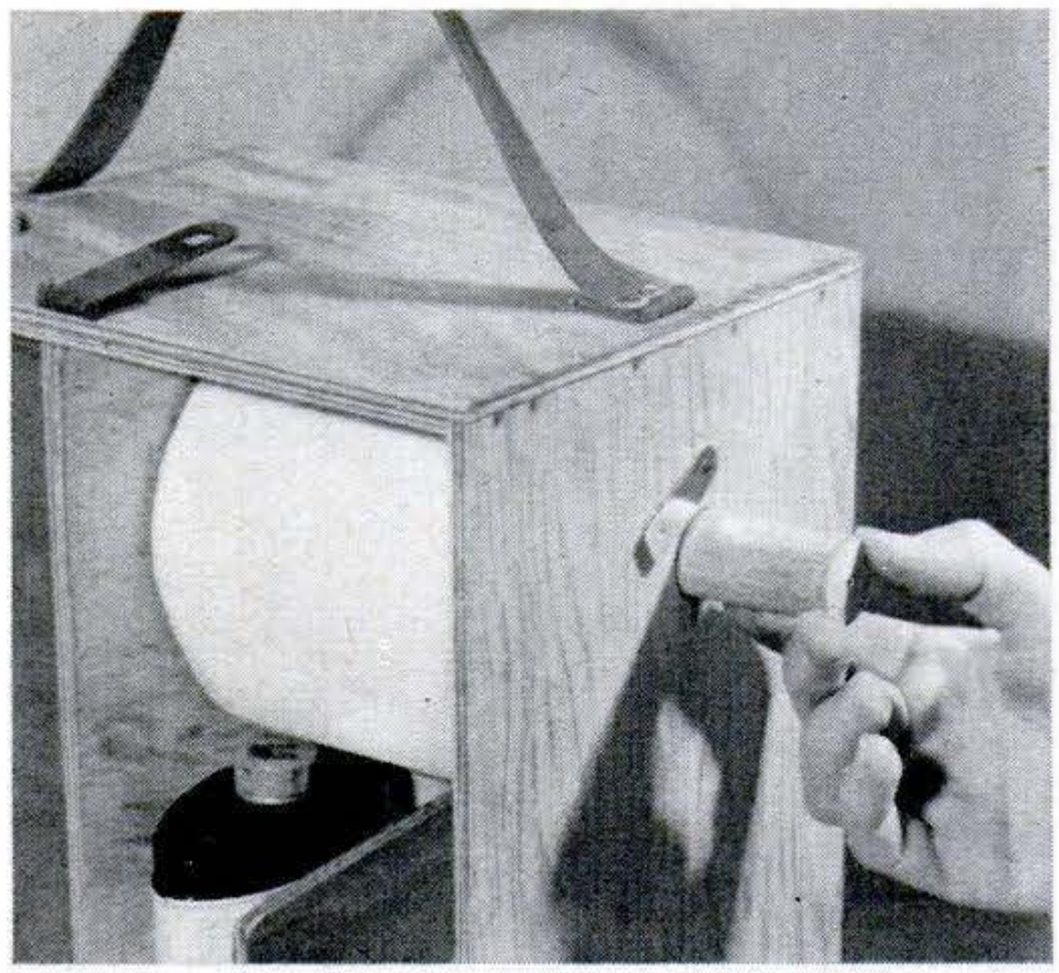
you probably will have to make your own from solderable, nonrusting sheet metal. The spigot is an automobile-radiator petcock secured by a nut, washers and solder, with a piece of copper tubing for the spout.

The washbasin shown here is an aluminum baking tin, measuring 2″ by 6⅜″ by 8½″, plus handles. If you want a wider or deeper one, it's easy to adjust the over-all dimensions of the container.

For the tank filler and cap, an aluminum 35-mm. film can was used. The can was fastened in place by cutting out the bottom, leaving ¼″-by-¼″ tabs that were spread inside the tank top and riveted. Seal with waterproof cement or putty.

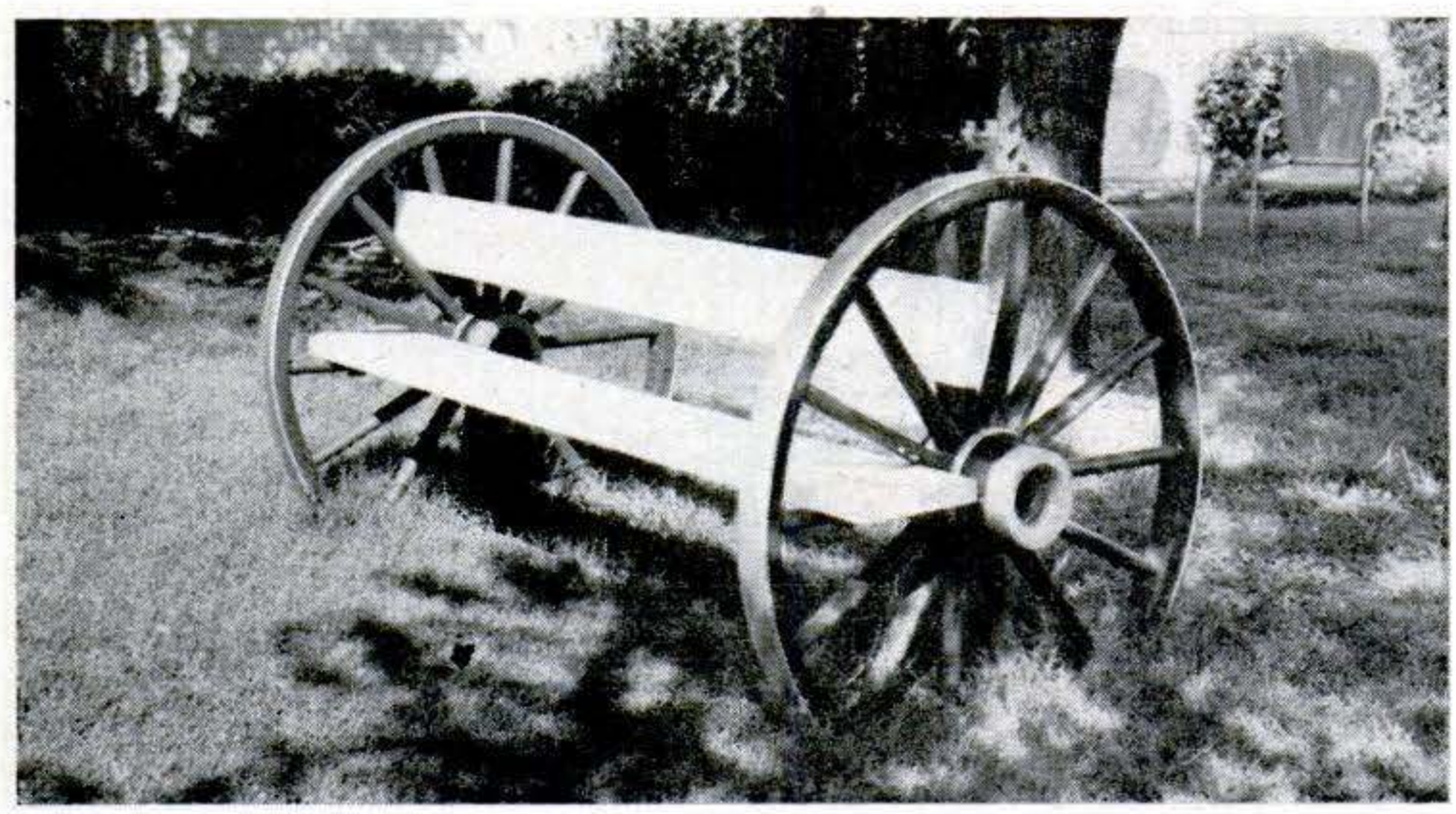
Quarter-inch exterior plywood was used for the case, with the exception of a ½″ top and a ⅜″ shelf.





PAPER-TOWEL DISPENSER holds a standard 11″-wide roll cut in half. A length of 1″ dowel or broomstick, held in place by a swiveled metal clip, supports the roll.

Wheels from an Old Farm Wagon Make Decorative and Useful Seat



Two discarded, wide-rimmed wagon wheels form the setting for this rustic bench, with the wheels embedded in concrete so that they won't roll away with you. The seat and back are two 2″-by-10″ planks, 8′ long, bolted to the spokes by cleats. The bench is brightly painted in red and white.—*Grover Brinkman, Okawville, Ill.*

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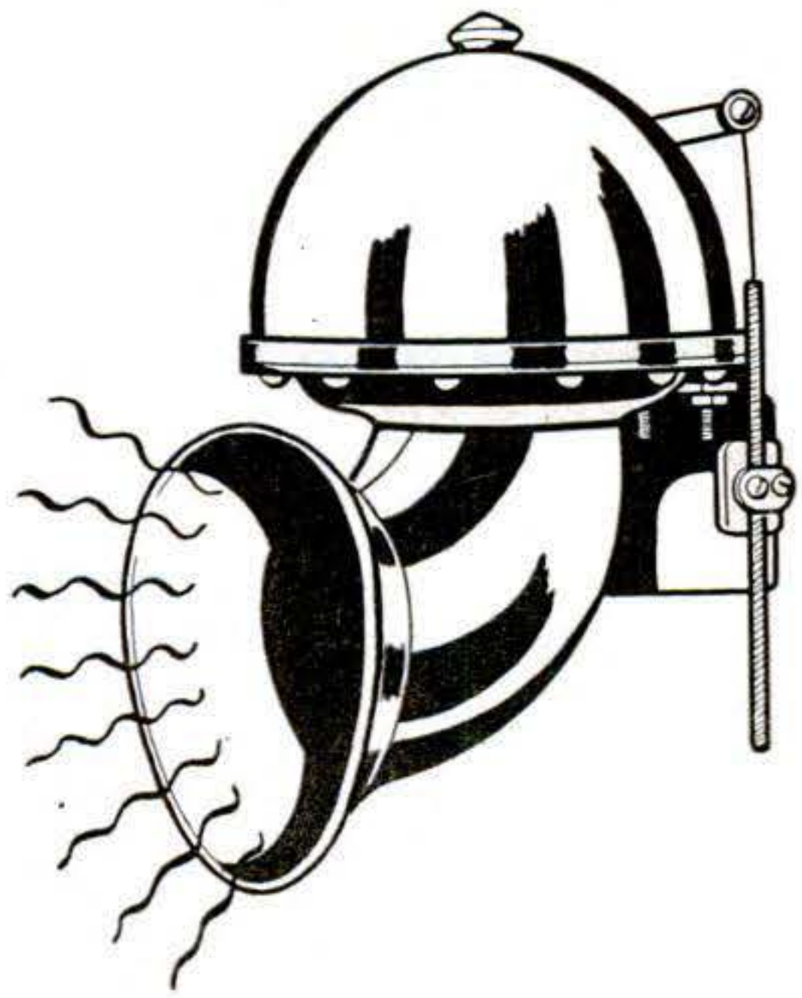
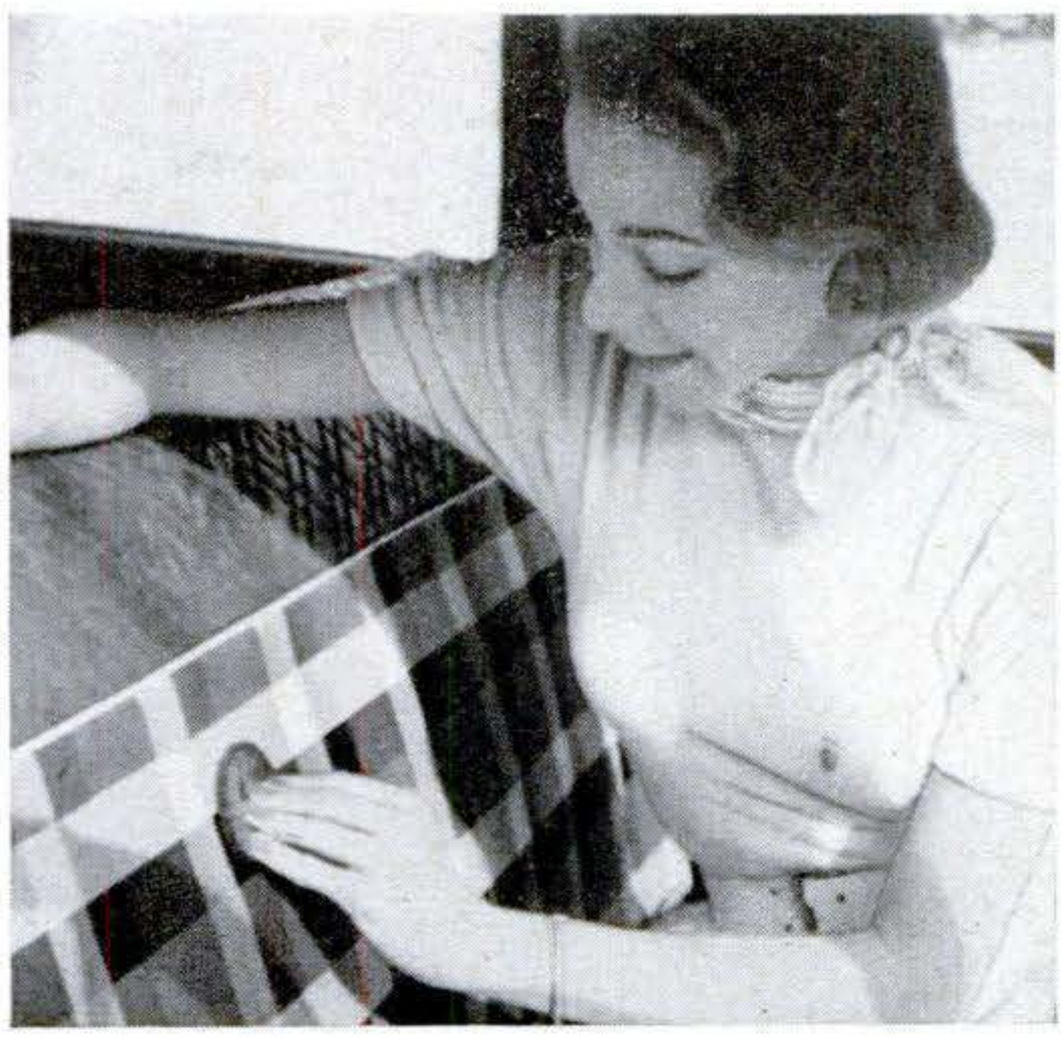
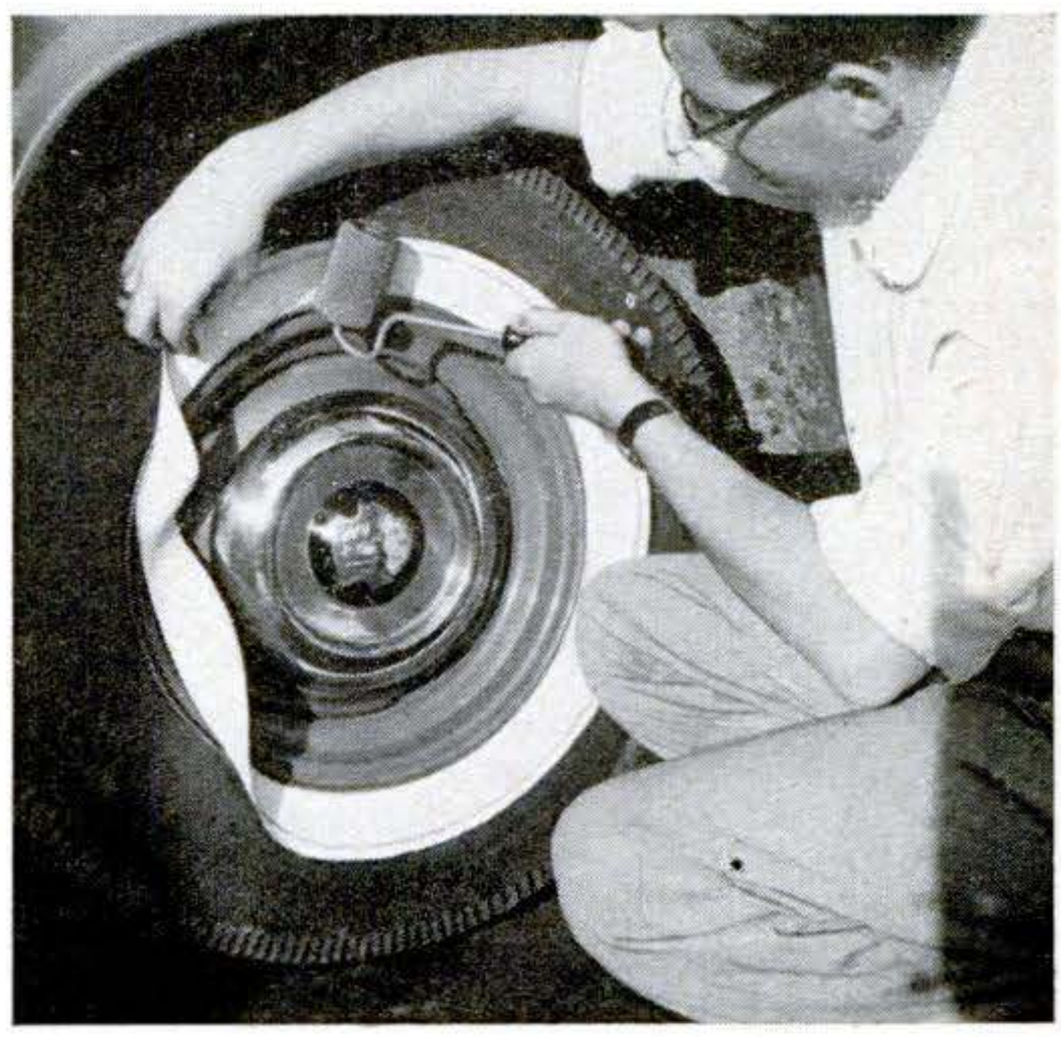
New for Your Car



1. Cattle Horn for Road or Range. You can sound off gently to warn pedestrians or roar full blast to get a slowpoke road hog over to the right lane with this variable electric horn—and its tone is guaranteed to attract cattle from the far corners of the grazing land. A control lever mounted on the steering column changes the stroke of the horn diaphragm to alter the pitch and volume. It is 8″ high and 5″ wide, can be installed without disturbing the horn already on the car.



2. Felt Disk Prevents Static Shock. Rubbing one of these felt pads over the surface of your seat covers is said to give protection from static shock for about six months. The pads, treated with a chemical that is harmless to fabrics and finishes, are packed in a plastic envelope for convenient storage in the glove compartment.



3. White Walls Go On Like Patch. You can have white walls put on your tires at nominal cost by a service department. The white covering is live rubber, ⅛″ thick, and is said to stay white and stick tight in spite of flats or bumping your tires against the curb. The manufacturer distributes the material only for shop installation.

Further information on the products described above can be obtained from: 1. Kattle Kaller Division, 1931 South 20th St., Station C, Omaha, Nebr.; 2. Braun Laboratories, 206 S. Hutchinson St., Phila. 7, Pa.; 3. Wite-Wall Rubber Co., 13225 Livernois Ave., Detroit 38, Mich.

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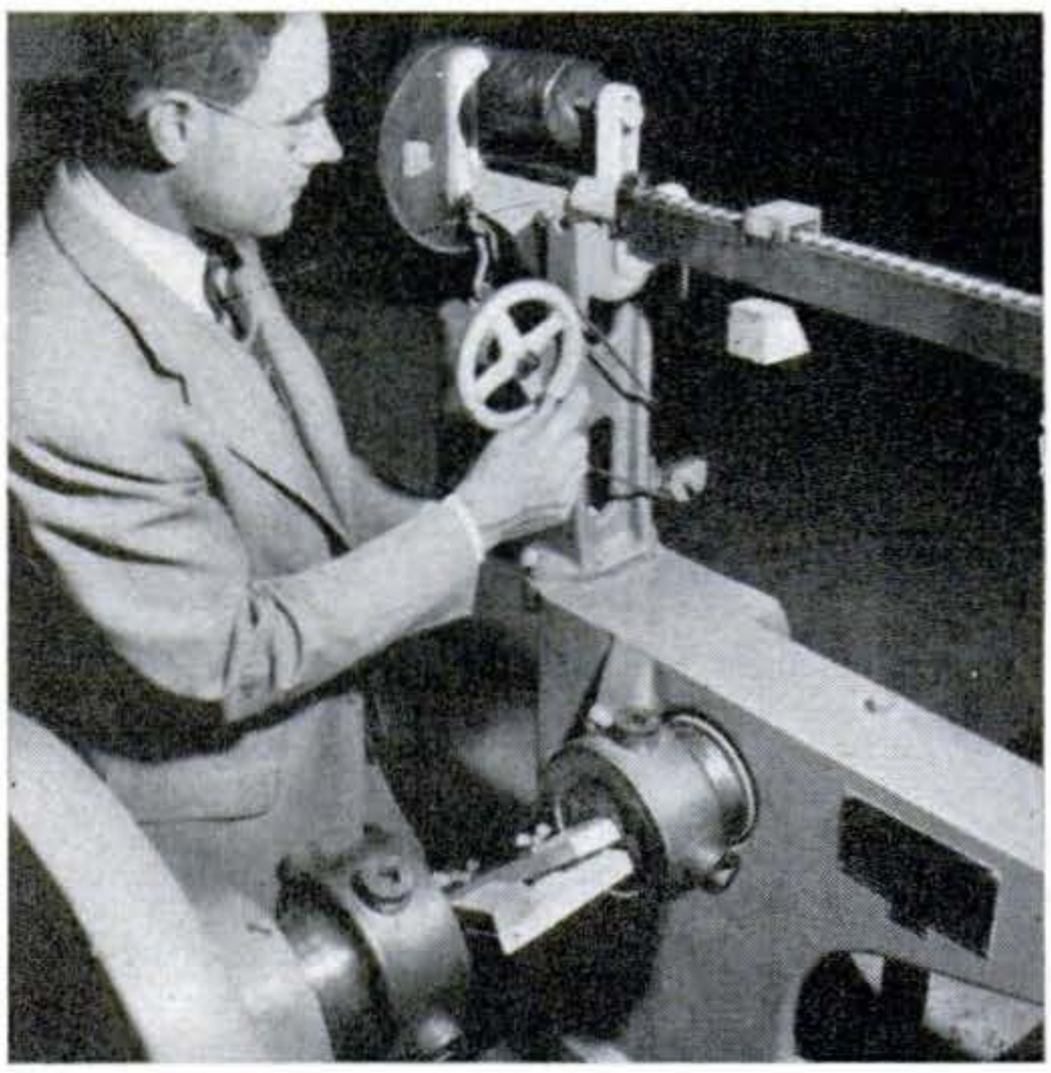
ONE TEST STARTS when Prof. Stern hammers different kinds of nails into a carefully graded board. Weeks to months later, he'll measure how hard they are to pull out.

College Examiner Is Rough on Nails



A TORTURING TWIST is applied to a furniture skid to find out exactly how much torque is needed to pry it open at its nailed joints. This test may save many a future table leg.

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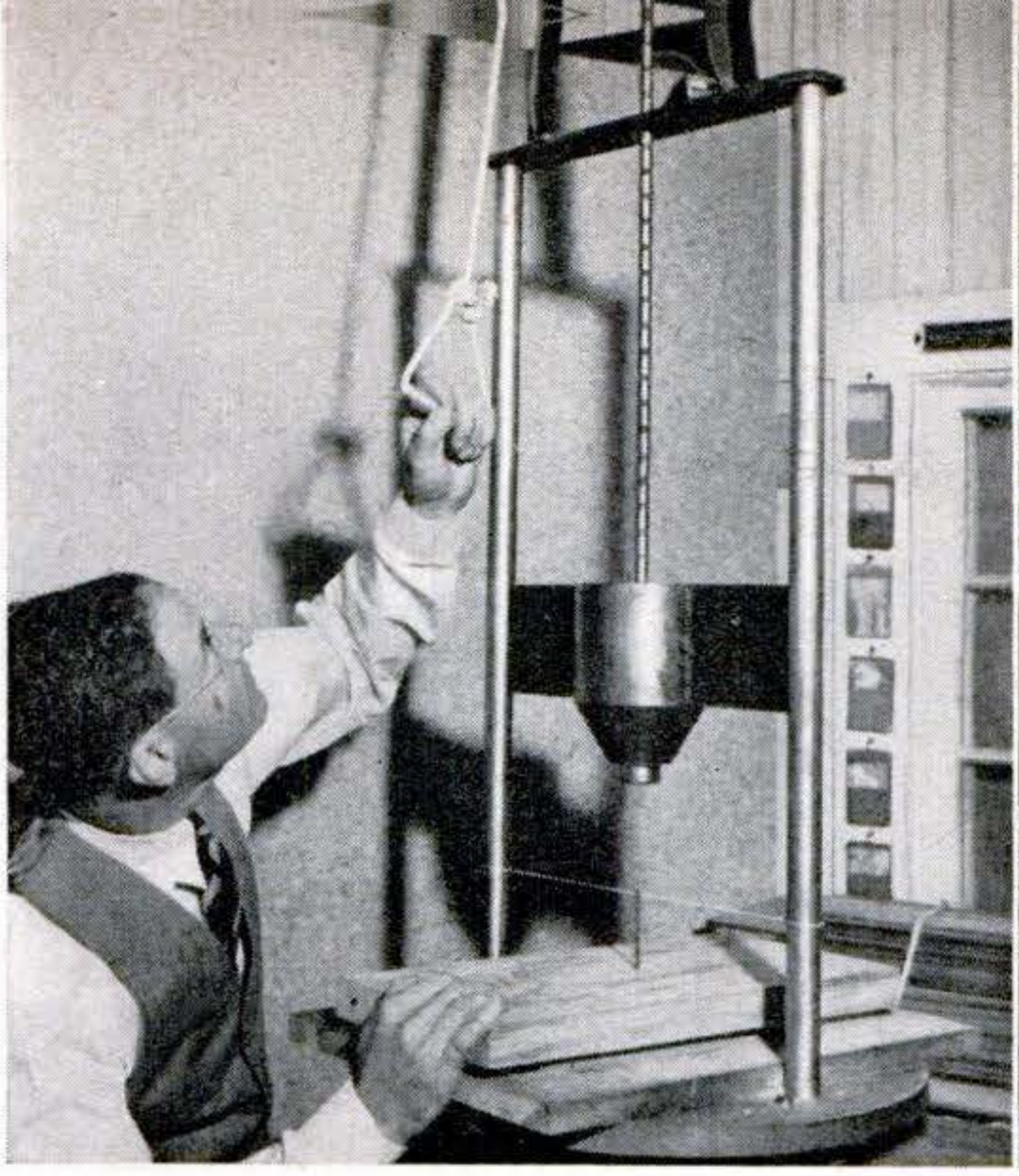
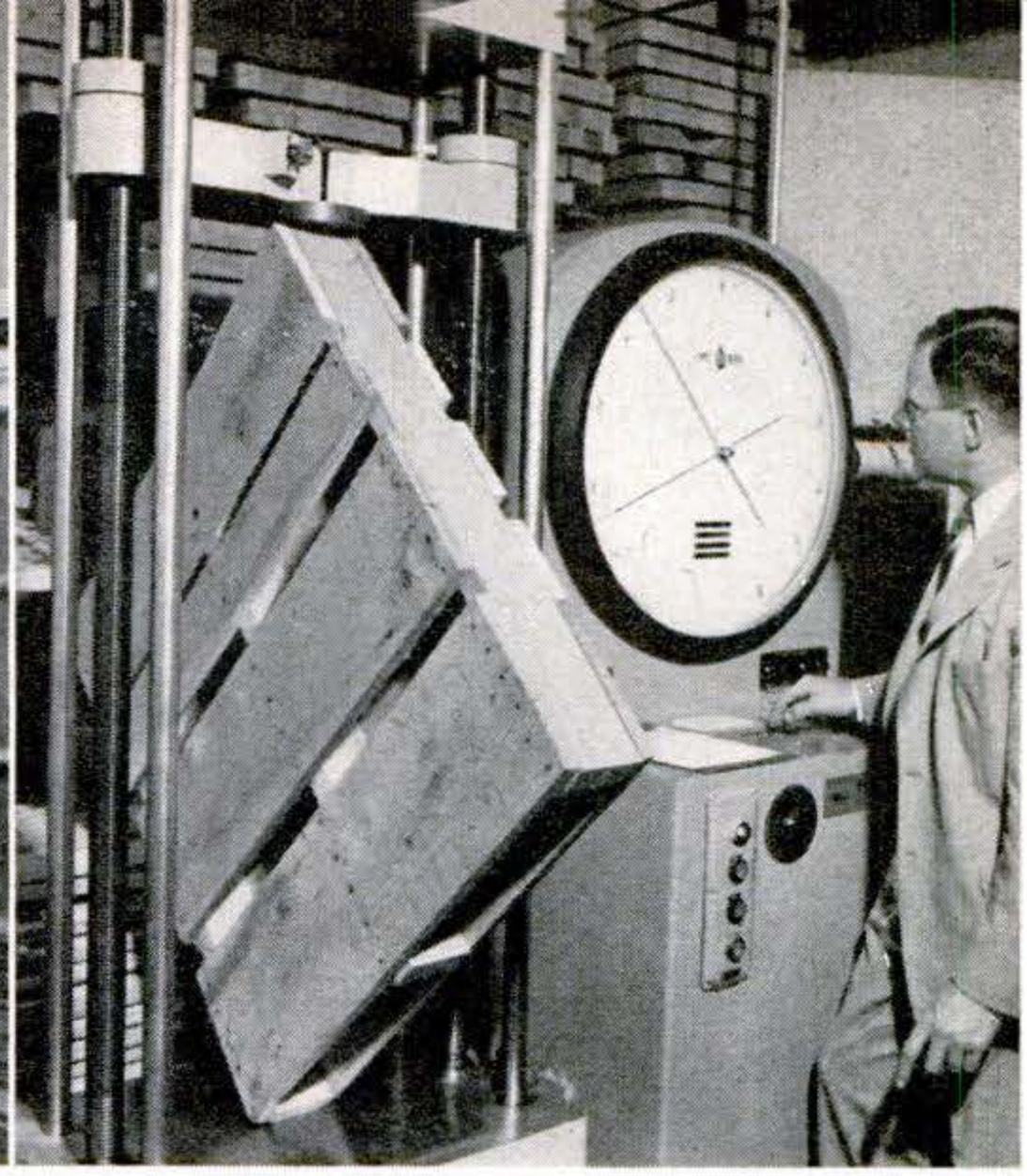


MEASURED BLOWS from the weight on this guillotine-like device reveal how readily a nail penetrates wood of known hardness. No human could hammer so consistently.



"IF YOU WANT TO MAKE a good pallet, you have to use a good nail," says Stern, here testing a pallet's rigidity on a machine that applies pressures of .10 to 12,000 pounds.

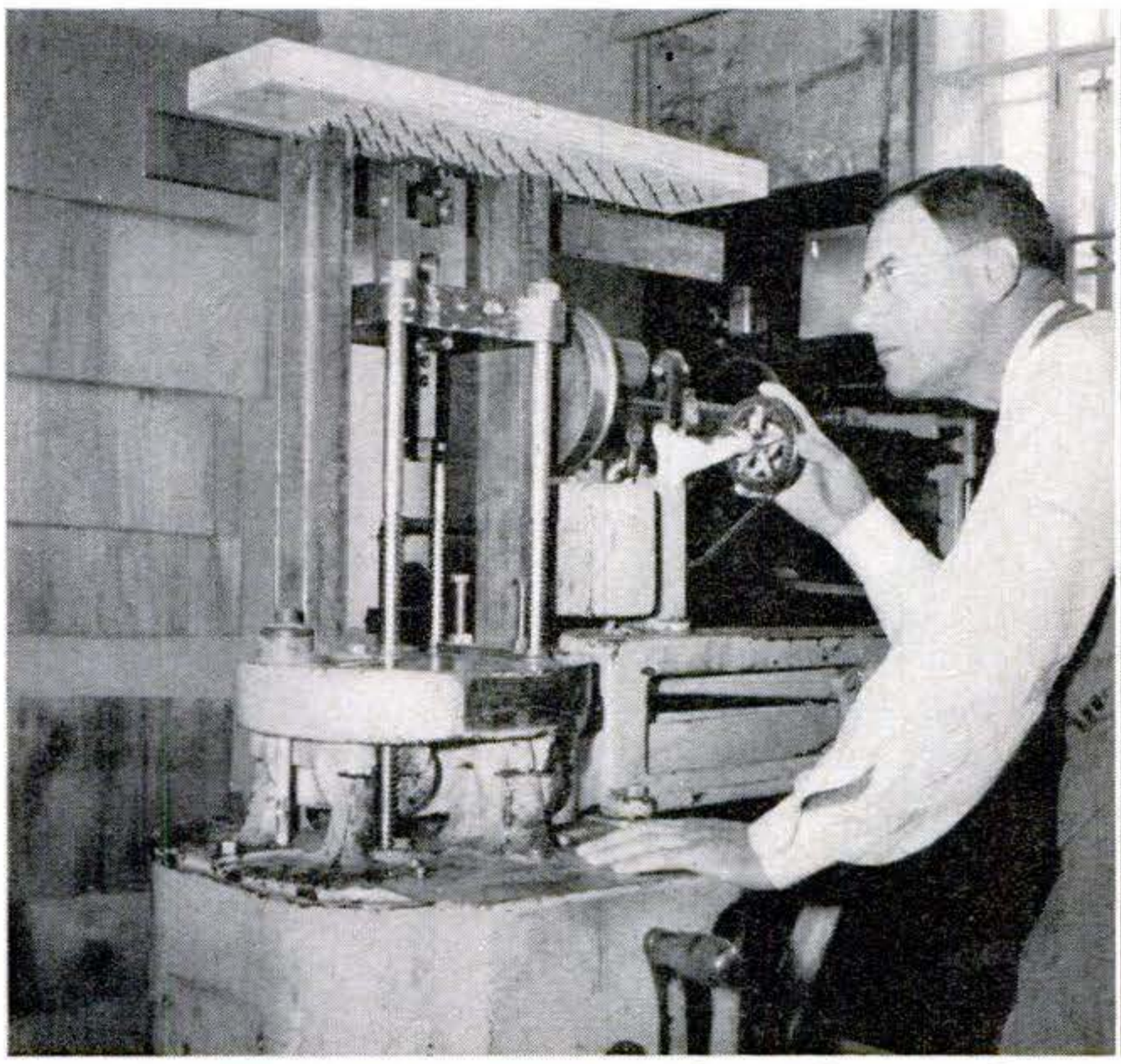
Only the best can pass Prof. E. George Stern's rigorous tests.

HUNDREDS of kinds of nails go to Virginia Polytechnic Institute and take exams from a research professor who knocks them for a loop.

E. George Stern is his name, and stern is his manner, too, towards what he refers to as "the indispensable fastener."

For eight years, Stern has done nothing but put nails through tough tests like those shown here.

Both nails and the building industry are the better for the experience.



SLOW AND STEADY is the pull exerted on driven nails by the motor-operated claw of this machine. Motor runs at a constant speed and the machine measures nails' resistance.

ONLY A CHARGING BULL, striking a wire fence, could match strength of yank that machine above gives driven fence staples. Cable on pendulum axis applies brutal tug.

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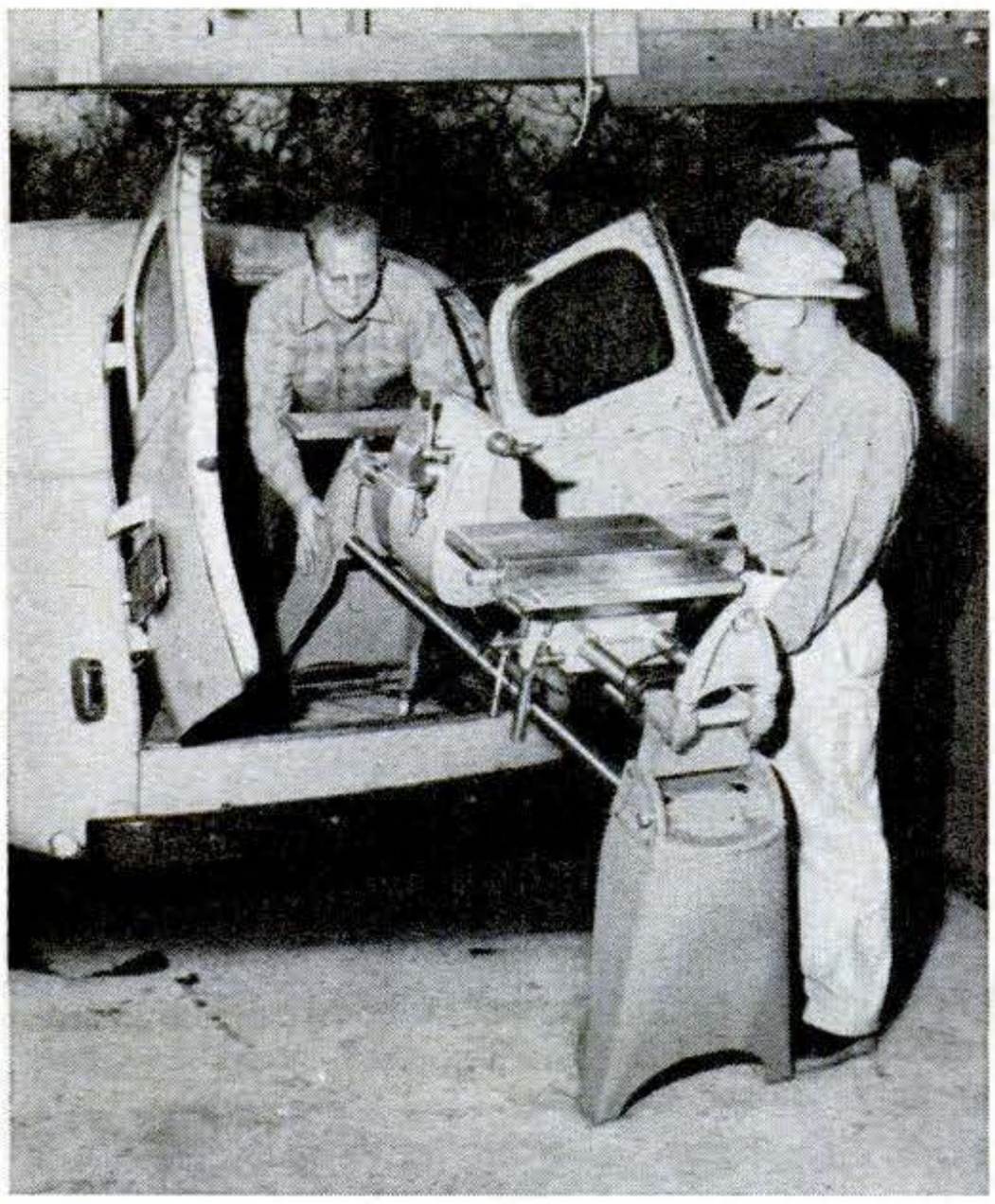
De Luxe Power Tool Whips Out Homework

New Shopsmith, styled like a home appliance, goes through its paces by helping build a table before your eyes.

By Paul Corey and Darrell Huff

THE longhairs are calling this the Do-It-Yourself Age. That means they have finally stumbled onto what most POPULAR SCIENCE MONTHLY readers knew all along: It's fun, and frequently profitable, to do things with your hands.

So 1954 is a logical year for the birth of a new Shopsmith. Called the M5, it is a multiple-purpose power tool designed solely for home-workshop use.



NEW MODEL comes ready to run—all you have to do is plug in the power cord. Besides motor and bench legs, it comes with a 9″ circular saw blade, sanding disk, miter gauge, drill chuck and centers. Tool being delivered to authors here was first M5 model manufactured.

What would you do if a truck unloaded one at your home? You'd probably do what we and our camera did: stand back and look at it, move in closer to see the details, and then put it through its paces. As your representatives, we had the opportunity of doing just this with the first completed model of the M5.

Pretty with a purpose. You'd probably be struck first, as we were, by its good looks. Here is streamlining with a purpose: safer use, easier maintenance. Protruding parts are a hazard and a dust-catching nuisance in a shop, and this tool is designed to have a minimum of them.

There's another reason for emphasis on appearance. In many homes you might want to put it alongside your wife's laundry equipment or in a basement recreation room. Attractively painted, the new Shopsmith looks like a "home appliance."

When you examine the machine you find that it comes ready to do five basic kinds of work, as the old Shopsmith did. The surprise is how much better or easier it does them. The M5 shifts in less than a minute to put its major parts, including a ¾-horsepower motor, to work in five ways:

- To begin with, you have a 9″ tilting-table saw.
- Slip off the saw arbor, put on a chuck, and you have a horizontal boring machine.
- Replace the chuck with a disk and you have a 12″ sander.
- Lift off the saw table, put in the tool rest and centers, and your lathe is ready to use.
- Or tip it to a vertical position and you

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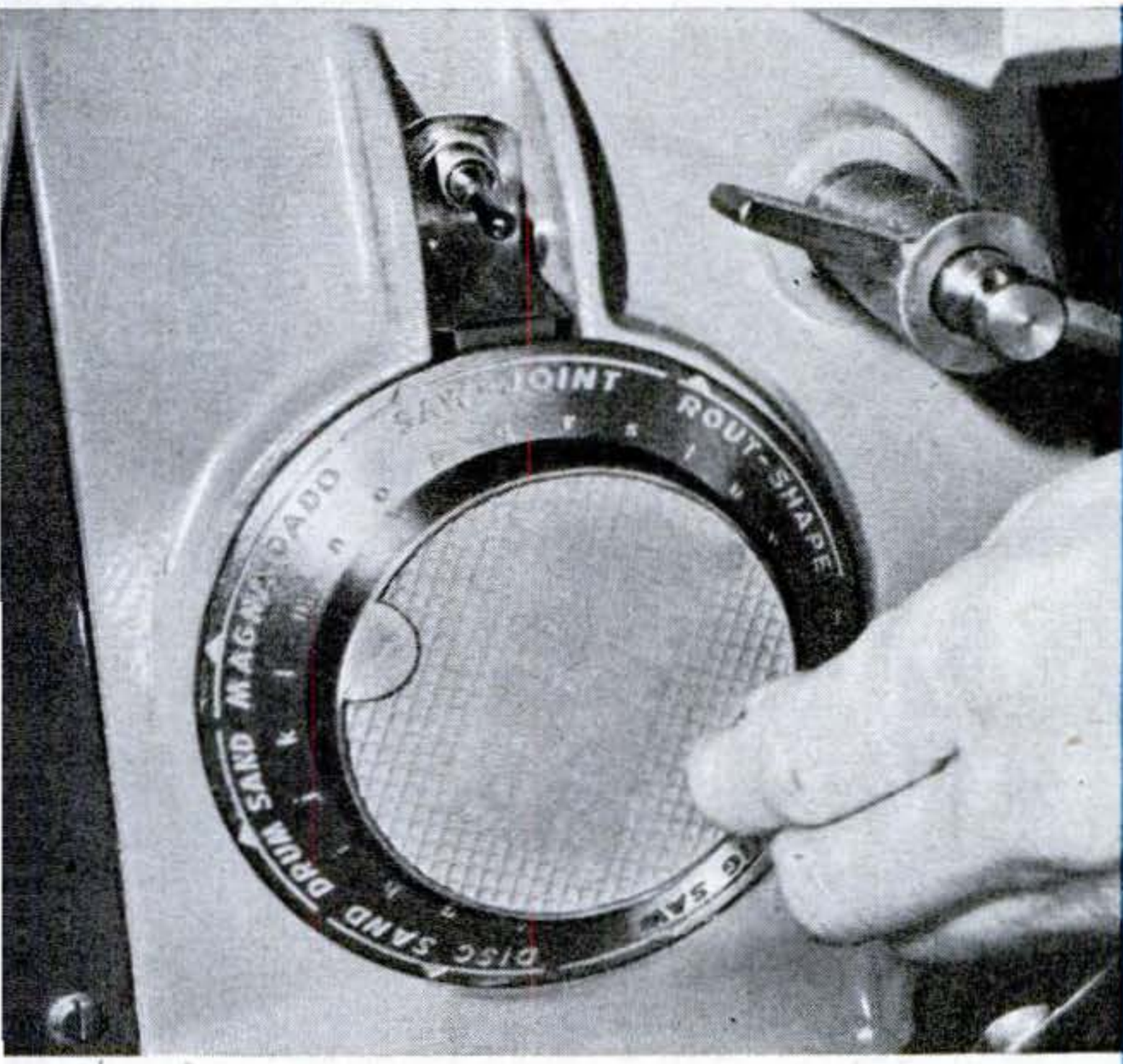

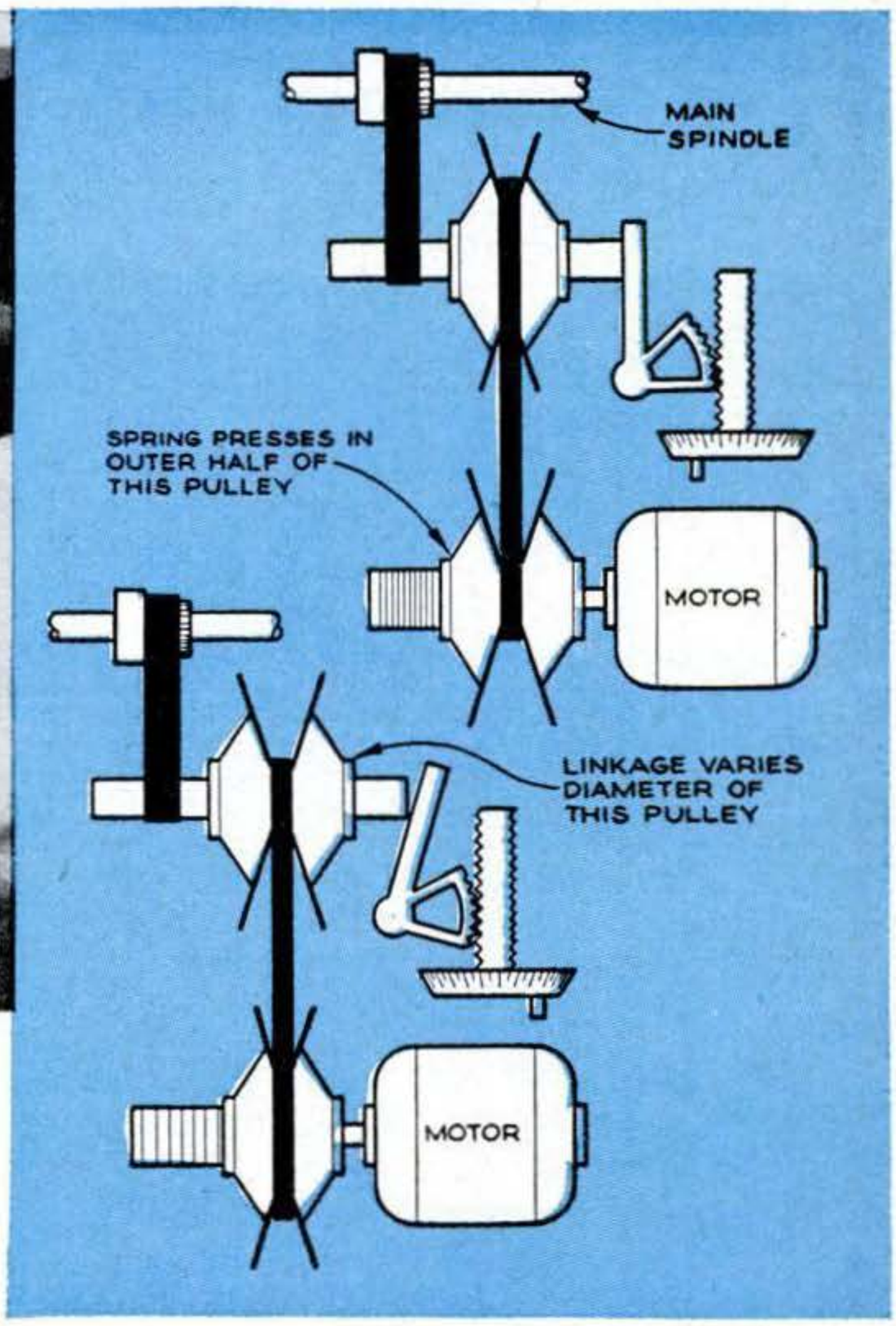

A BUILT-IN SPEED CHANGER is the biggest news in the M5 model. You simply set this dial on the headstock at the proper speed for the tool you are using—in this case, 3,400 r.p.m. for the circular saw. Drawing shows how it works: worm moves a sector that changes diameter of jackshaft pulley. Final drive to the main spindle is by a toothed rubber belt.

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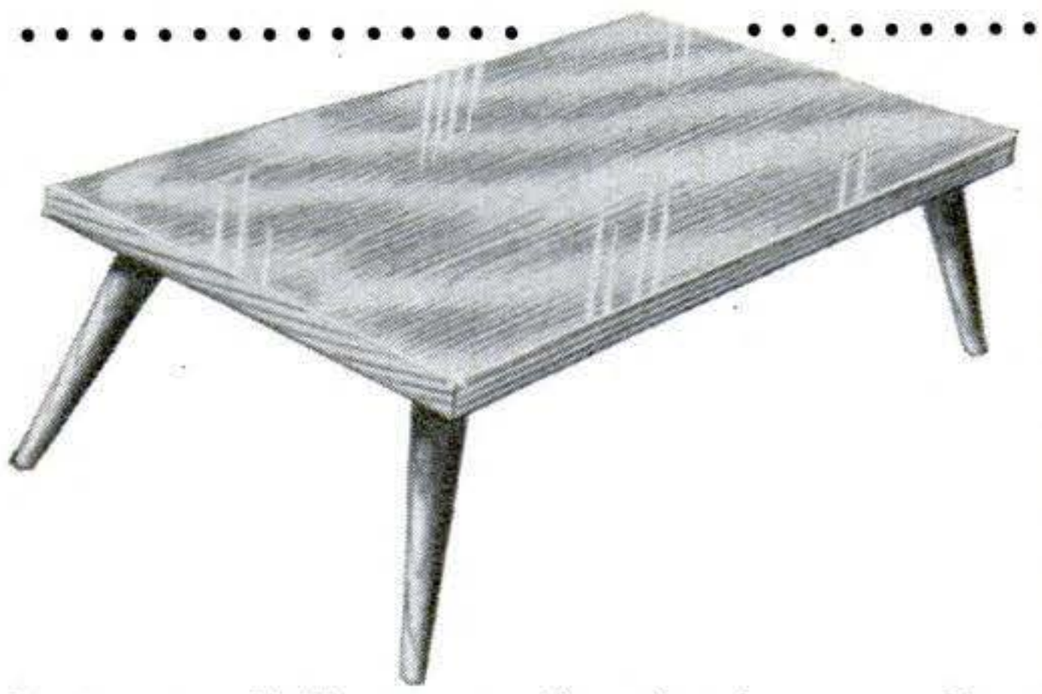
How a table is built with the new tool



have a drill press for boring, routing, shaping.

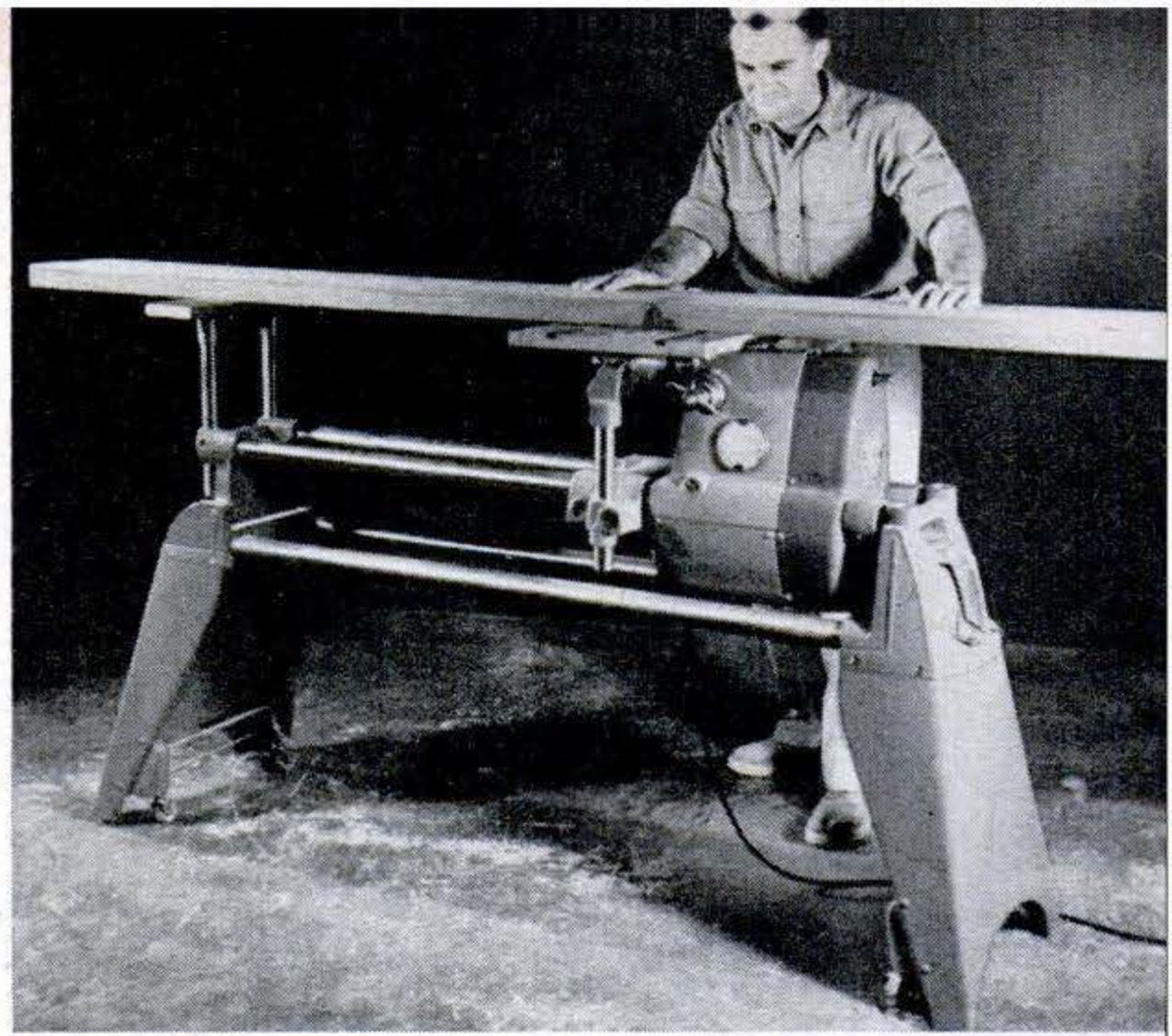
Dial sets speed. In every position you have something new: A speed changer built into the M5 permits you to dial any speed from 740 to 5,900 r.p.m. You'll want that slow speed for such things as large-diameter drilling, the high speeds for routing and shaping. Those in between mean that any job can be done at the *right* speed, with no compromises. And because changing speed is easier than cranking down a car window, you're never tempted not to bother.

The M5 has an inconspicuous little something called "power mount" that its makers are very proud of. This is a pair of openings in which additional tools can be rigidly mounted, plus two new power spindles on the headstock casting. Just about any auxiliary tool the Shopsmith people produce can be mounted and put into action in well under 60 seconds.

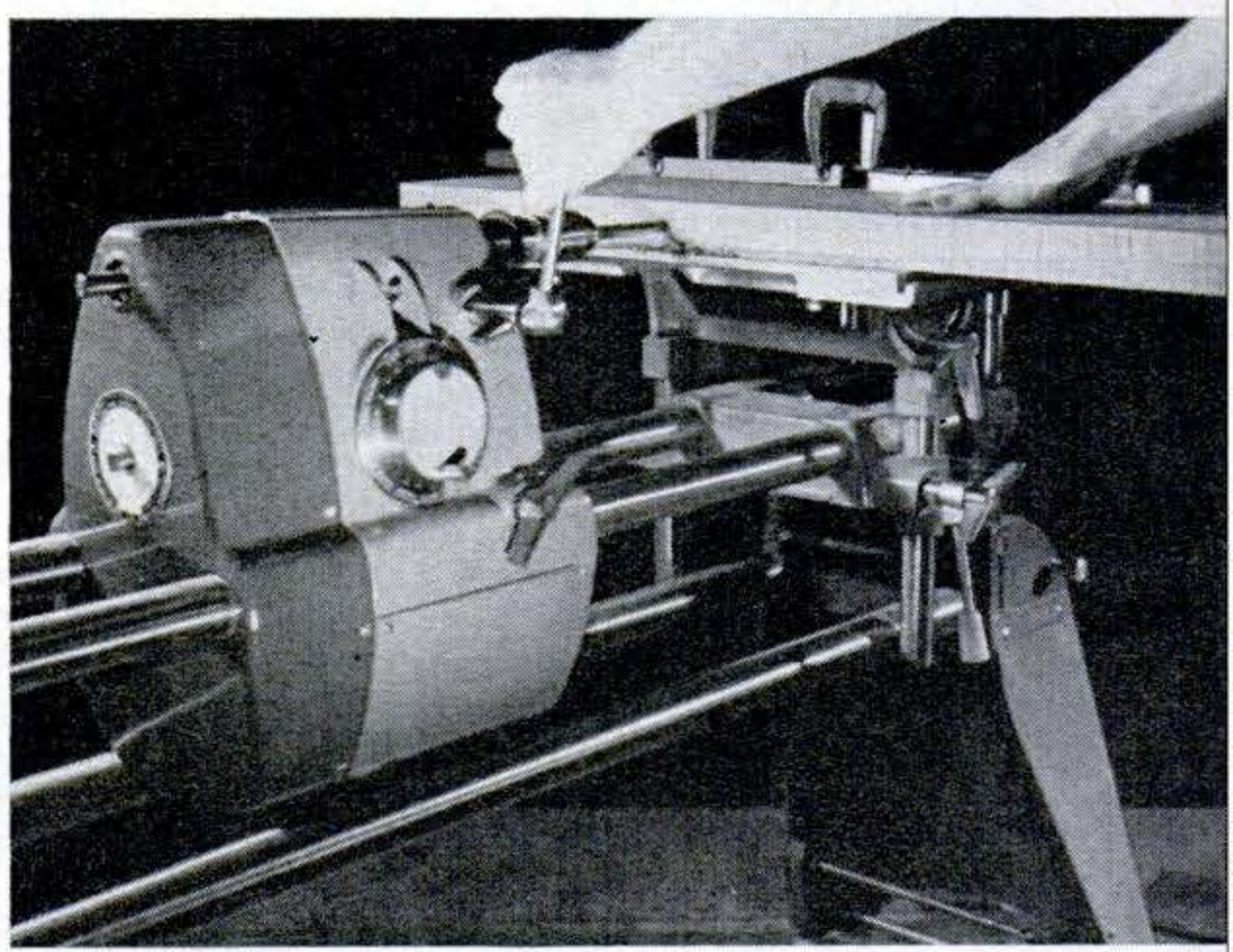
One of these, a 4″ jointer, is already in production. So is a jigsaw. A bandsaw will be ready shortly. Others will follow.

The stranger to Shopsmith will probably be most impressed by the way things work together. Whether you are drilling, sawing, sanding, shaping or routing, you use the same headstock, motor, frame, quill assembly and table. This means that the big table with its fence and miter gauge are part of the sander and drill press. You have all the adjustments available at all times. Example: you can combine fence and miter gauge to make a variety of jigs for sanding; and the same feed that you use for drill-press work carries the disk sander to just where you want it.

Changes for convenience. People who know the old Shopsmith will be most taken by some of the new conveniences. The built-

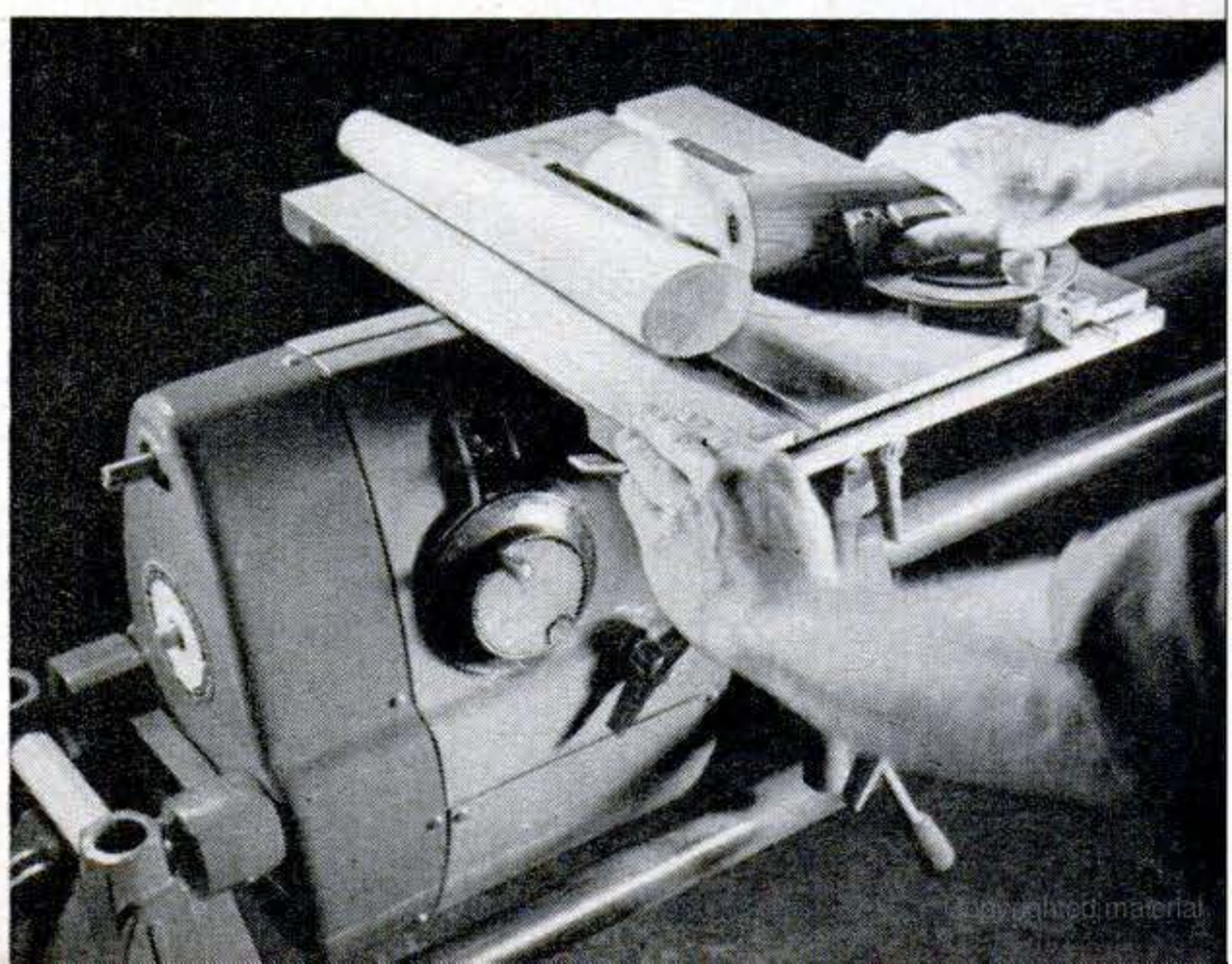


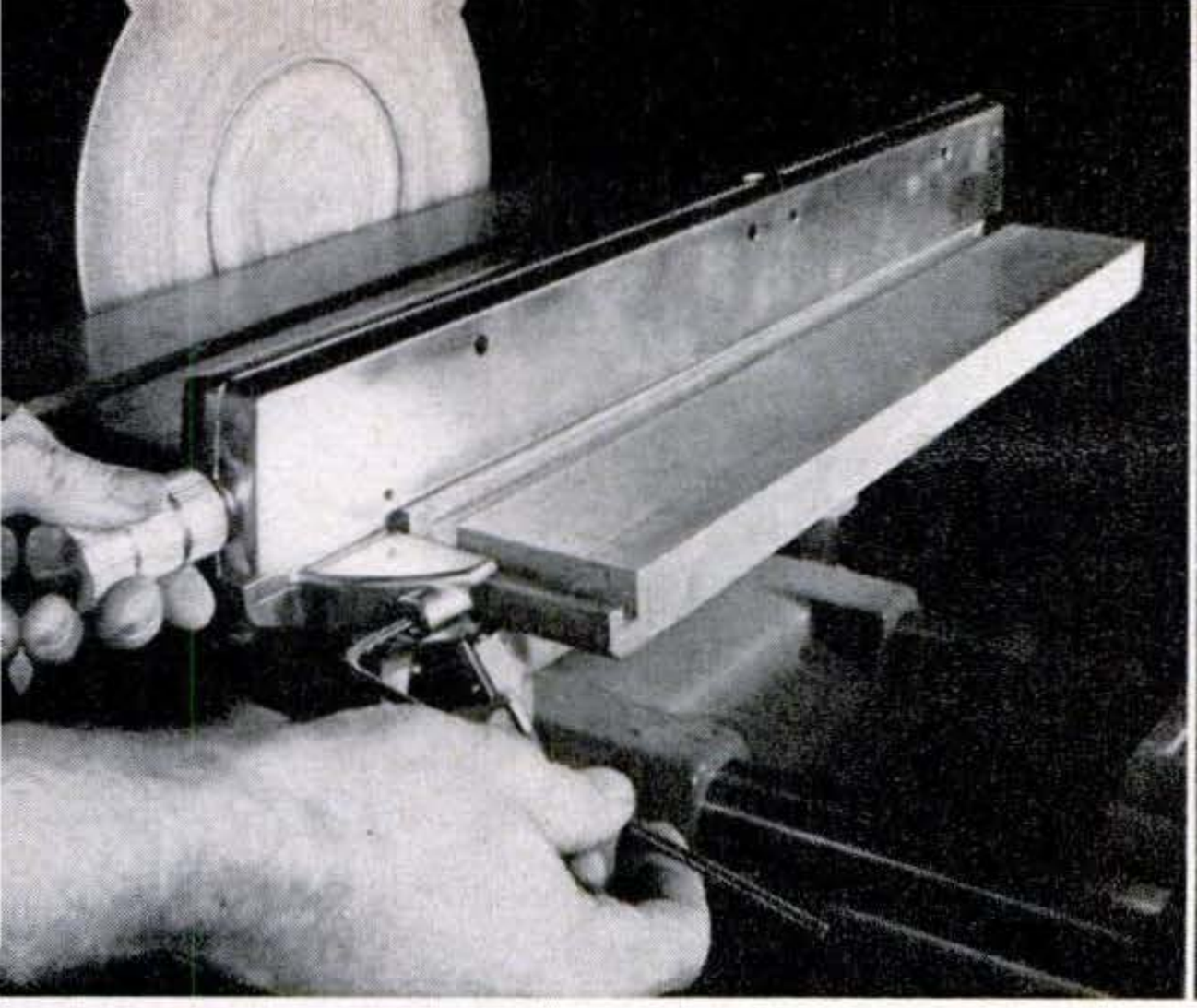
1 START WORK making the coffee table shown at the left by cutting a 2″-by-10″ plank into three 40″ lengths. Extension table and deep cut simplify handling long, thick pieces.



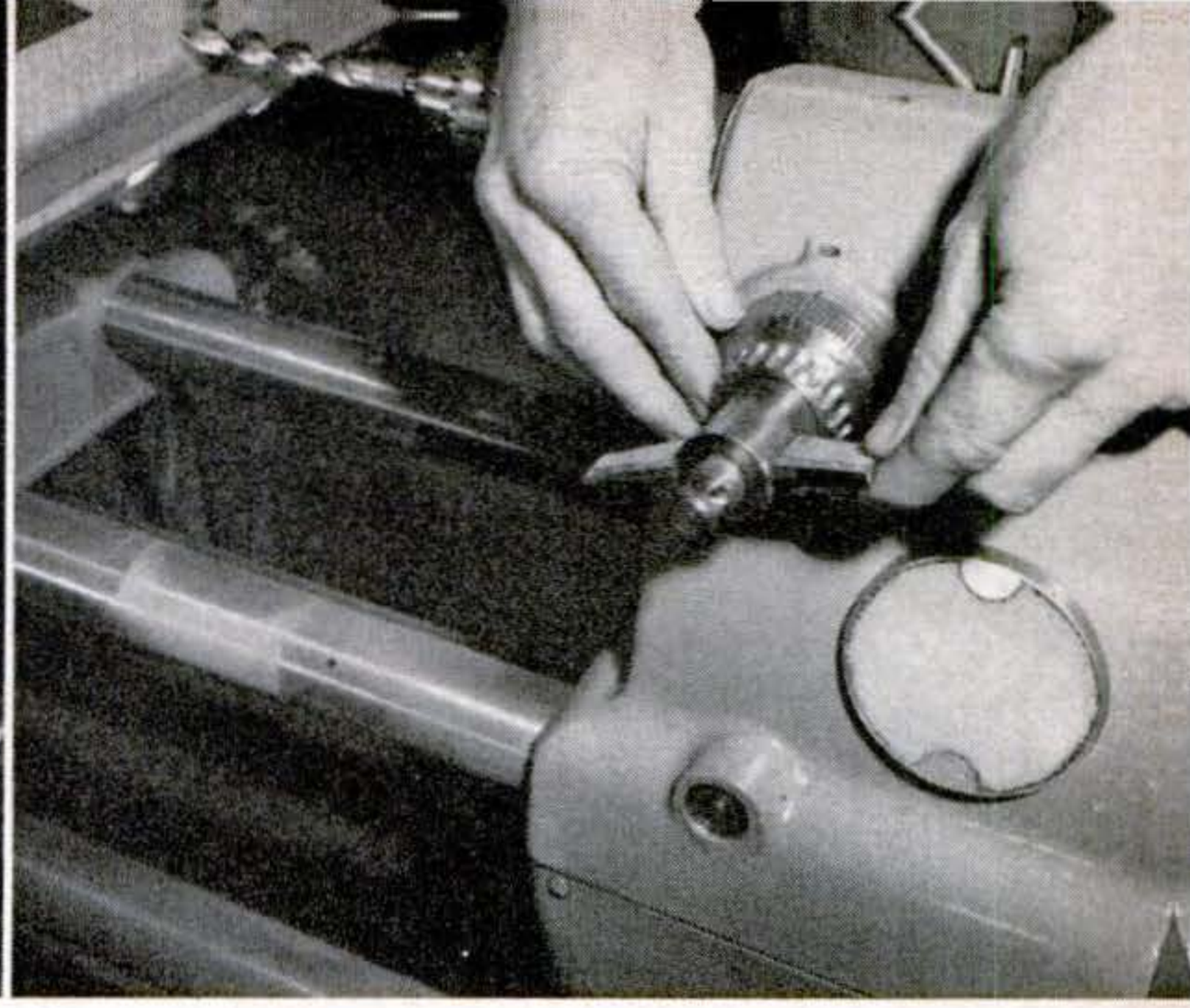
4 FOUR DOWEL HOLES are then bored in what will be inner edges of each plank. The locked rip fence backs up work; guide C-clamped on fence holds wood flat on table.

7 ANGLE-CUTTING tops and bottoms of tapered legs is not complicated. First step: with saw table level and miter gauge at 75°, big end of each leg is trimmed.

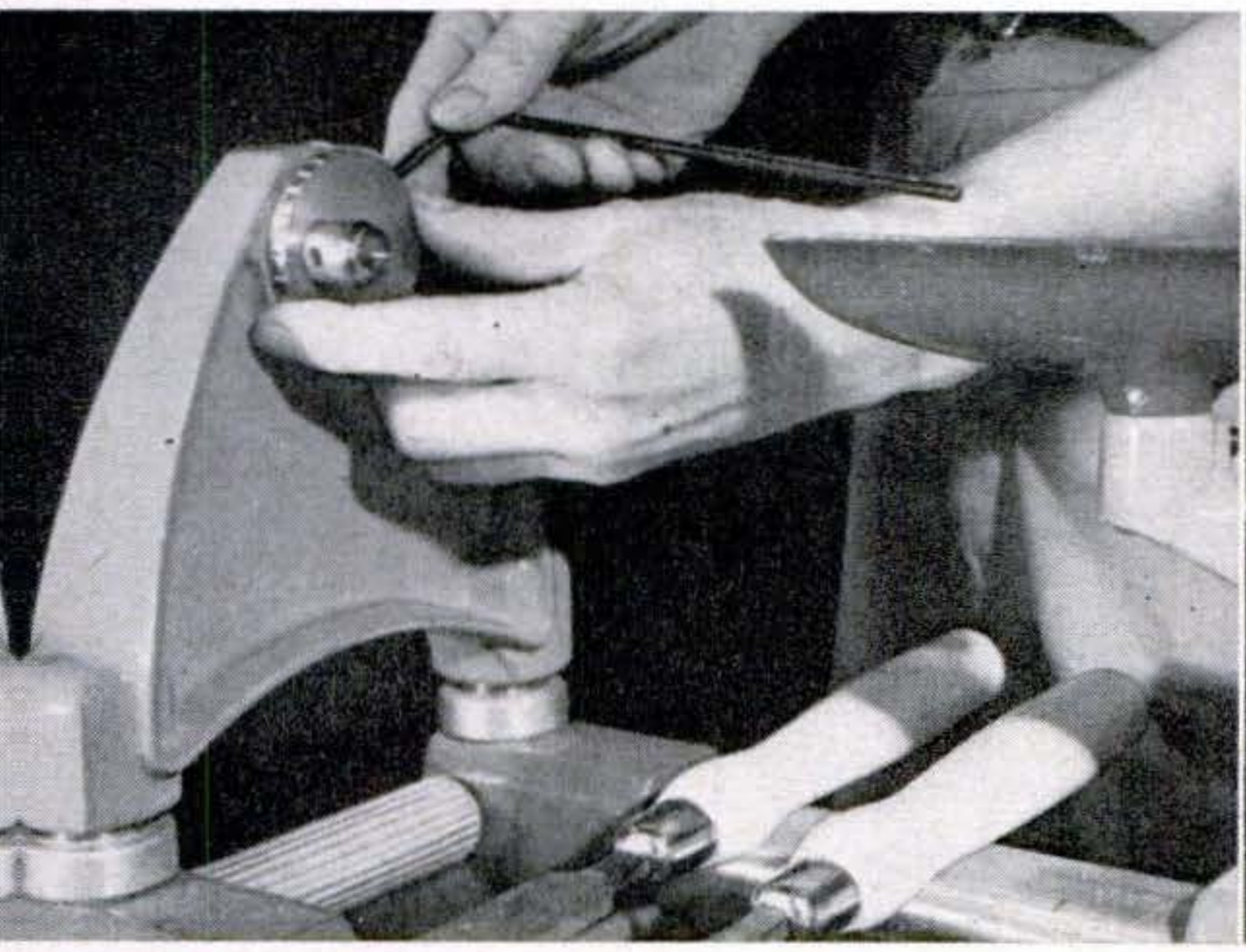




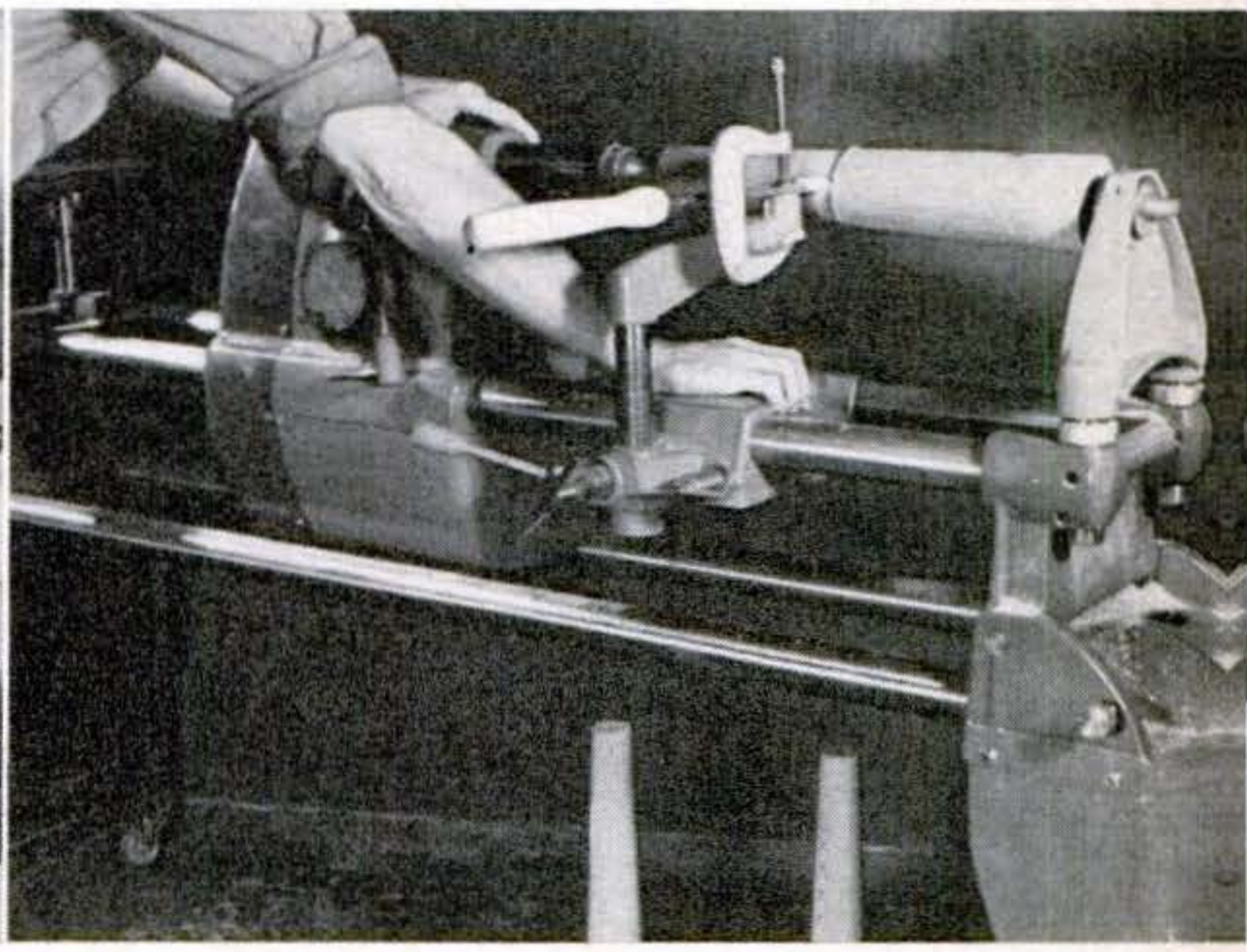
2 OFFSETTING FENCE for edge-finishing with disk sander is now a cinch—you loosen fence lock and turn offsetting screw with an Allen wrench. Edge-sand the three pieces.



3 DEPTH STOP on spindle helps in doweling job. With drill chucked, you lock quill temporarily with drill touching work, set the depth dial a bit over half the dowel length.



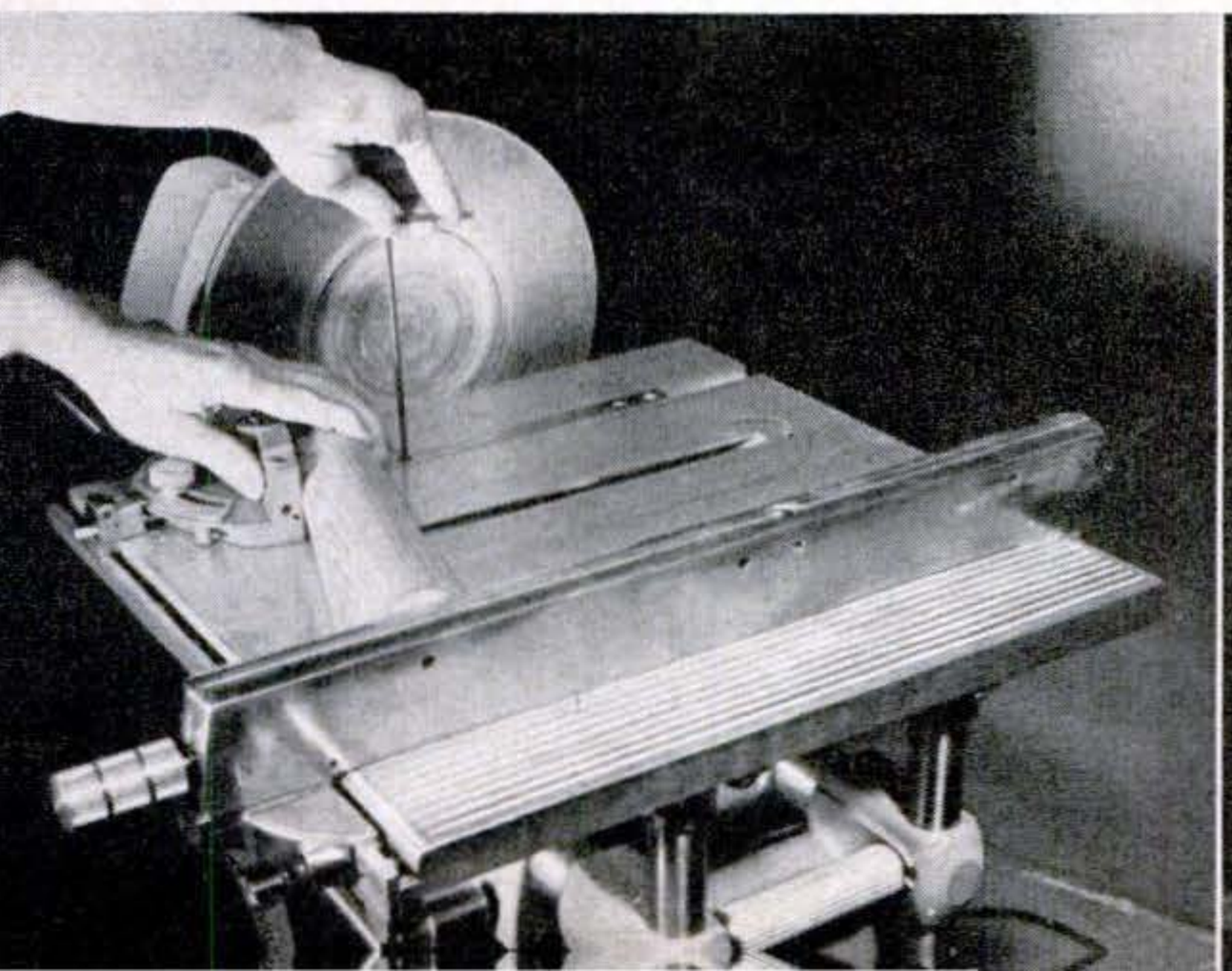
5 ECCENTRIC CENTER aids in repeat taper-turning, as for table legs. Rotate tailstock fitting to desired taper and lock it there. First turn four legs to straight 2⅝″ cylinders.

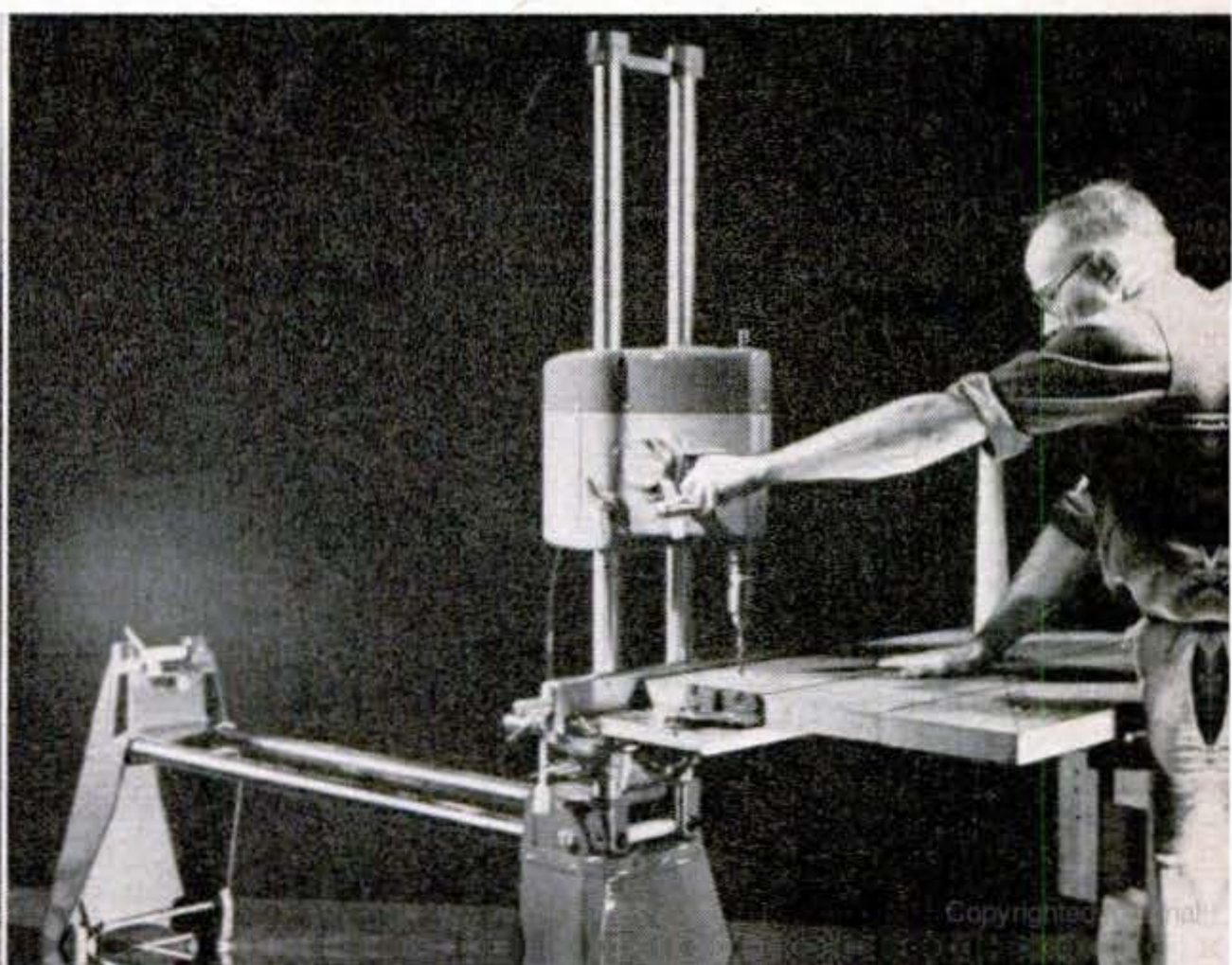


6 NEW TAPER-TURNING SETUP uses turning tool clamped to rest, which is slid along ways. Table legs are 14″ long, taper 1″. Toolrest height is set by new rack and pinion.

8 SANDING BOTTOMS parallel is next step. Cut end is butted against fence and miter gauge slid up and locked in with an Allen wrench. Then sanding disk is fed to leg.

9 LOCKABLE miter gauge and fence make fixture to locate dowel holes in underside of table for legs. Now glue in the legs and give the completed table a clear finish.





in speed changer with finger-tip dialing undoubtedly is the most important of these. But there are other features that users will also welcome:

1. The turn of a crank raises or lowers the saw table. The rack-and-pinion mechanism that does this also adjusts the height of the lathe tool rest.

2. The miter gauge can be locked to the table to form a jig. An Allen screw simply expands the bar in the table slot.

3. Depth of drilling is controlled by simply setting a dial.

4. The aluminum saw table is bigger, smoother and stronger.

5. The extension table can be put at either end of the machine.

6. The rip fence aligns itself and locks with a single twist of the handle.

7. The lathe cup center can be offset up to ½″ for turning tapers to a maximum difference of 1″ between diameters.

8. Turning a setscrew offsets the fence slightly, when you want to use the disk sander for edge-finishing. You no longer have to cramp the fence manually and by guess, and then lock it in place.

9. Table trunnion and miter gauge have automatic stops at the settings that are most frequently used.

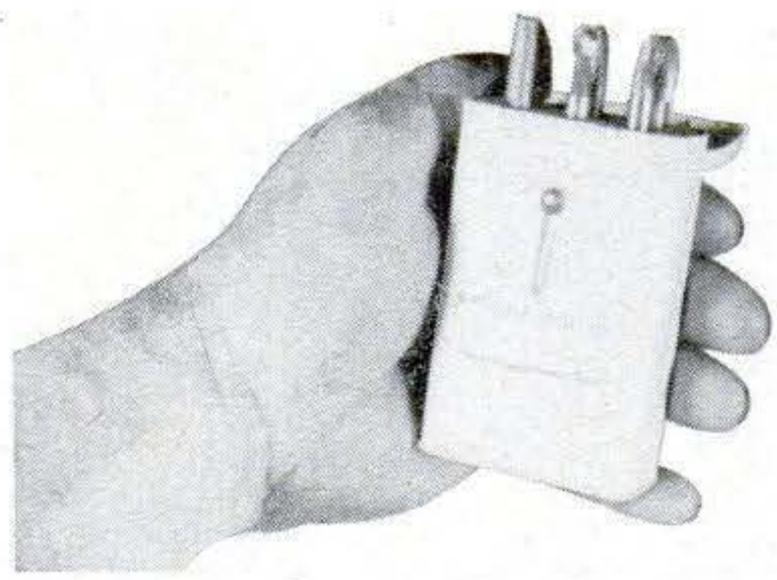
10. Maximum depth of saw cut is now 2½″, which also means 45° cuts are possible on full 2″ lumber.

The underlying idea back of these changes is to make power woodworking easy for the green hand as well as the experienced man. In line with this, the new Shopsmith arrives ready to use. There is no setting or mounting. Like an automatic refrigerator, it is simply plugged into the nearest outlet and put to work. When you are through using it, the tool can be rolled off to an out-of-the-way parking spot.

The makers expect the price tag to come as a pleasant surprise. At $269.50 it is priced, they point out, no higher than the old model including speed changer, bench ends and a ¾-hp. motor—all of which are among the things that are standard parts of the M5. END

Cradle Makes Globe Easy to Use

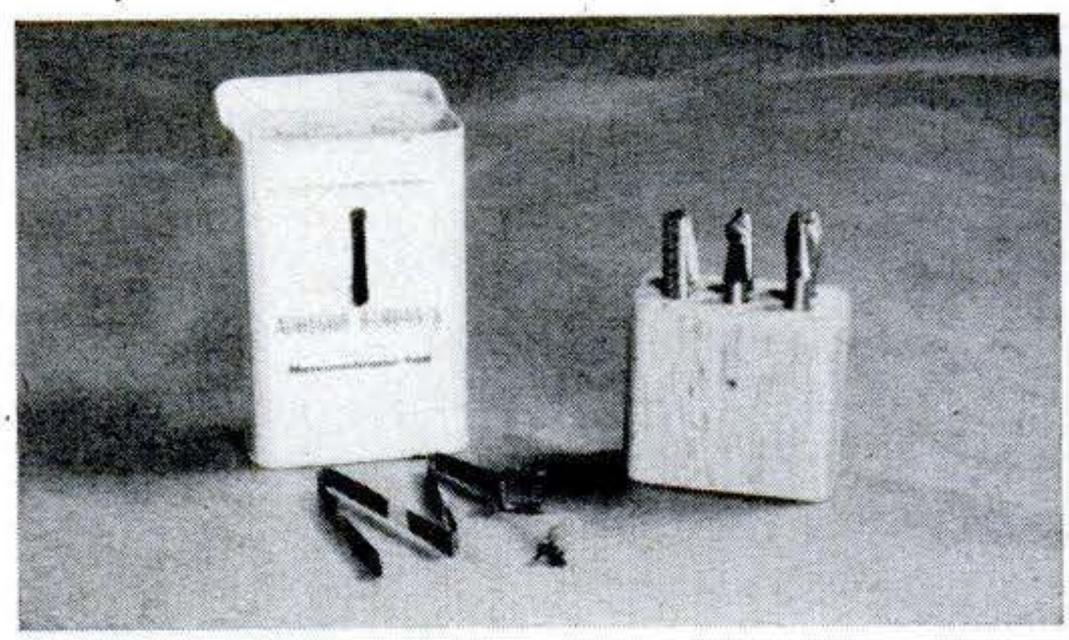
You can pick up a map globe like a ball and carry it to a chair for comfortable examination if it is kept in a cradle mounting. In this case, the globe was removed from its fixed-axis mount and placed on a clock case from which the works and face had been removed. The dial rim makes a good ring support for the globe. Jigsaw owners can quickly cut inverted arches to match the globe curvature and interlock them at 90 degrees, if a clock isn't available.—*Carlton Bucher, White Plains, N.Y.*



Pop-Up Case Holds Rotary Files

A SPRING bent from a corset steel or clock spring pushes up files or drills when you lift the lid of this bandage case.

Shape a wood block to slide loosely in the can and drill it for the bits. Staple the spring to the block bottom and press it into the can. A screw driven part way into the block through a front slot keeps it from popping out too far.—*Keith Heryford, Cedarville, Calif.*



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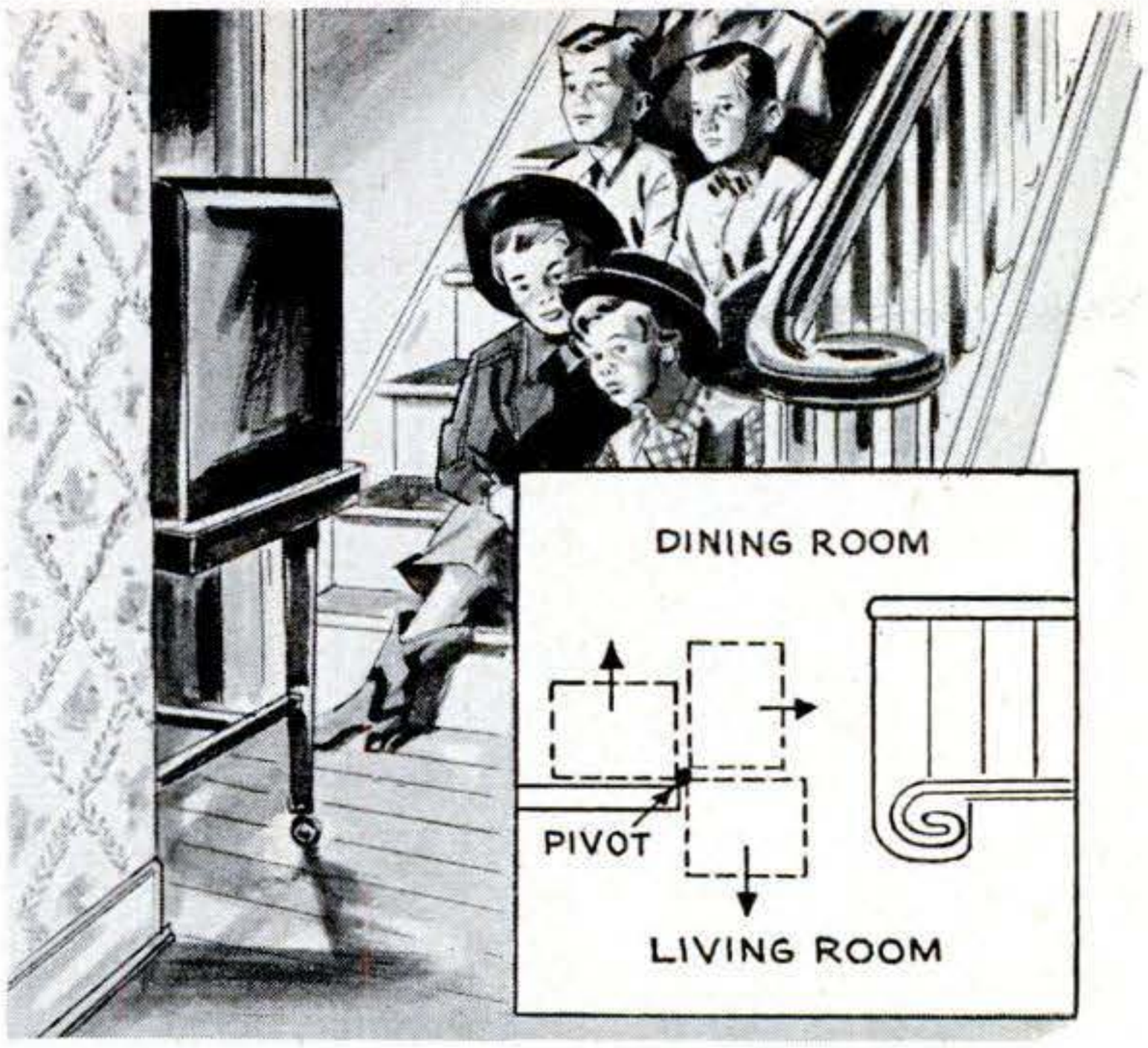
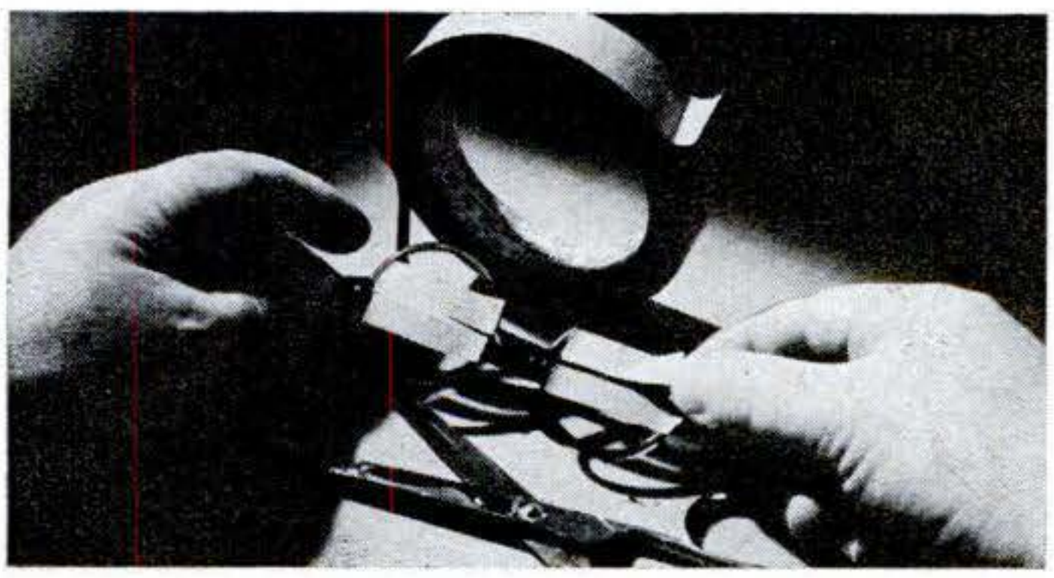


Television Set on Hinges Faces in Three Directions

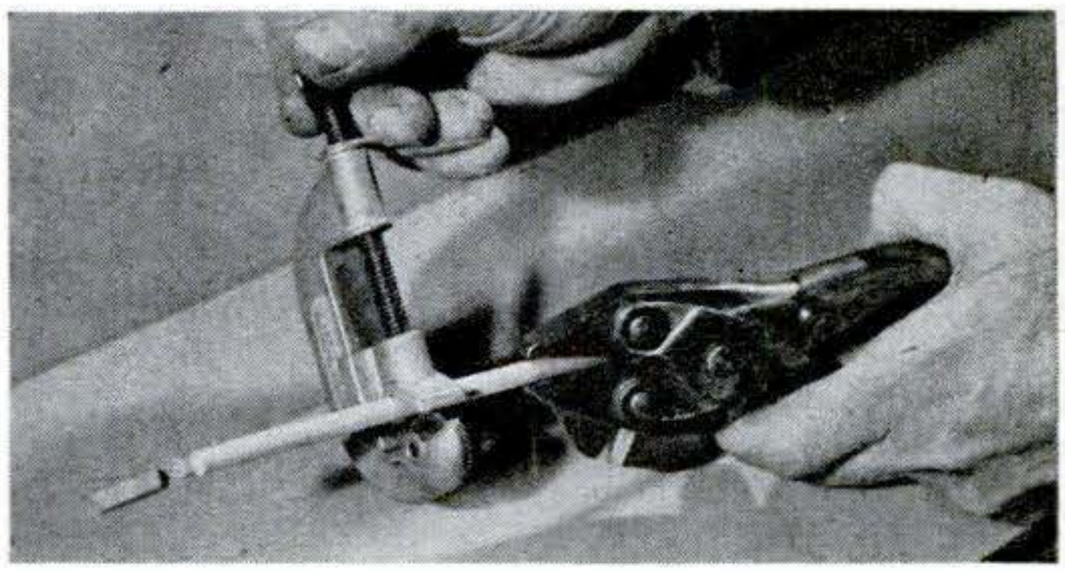
OUR TV set took up too much space in the living room until we mounted it on a hinged shelf attached to the end of the hall partition. Now it can be swung around to face either the living room on one side or the dining room on the other. When it's turned straight ahead, the stairs make an ideal grandstand for kids' shows.

The pivoting leg should be attached to the wall with sturdy hinges, and the other three corners can be supported on legs with casters so the set will roll easily.—*Addison U. Moore, New Egypt, N. J.*



Slits Help You Drive into Sun

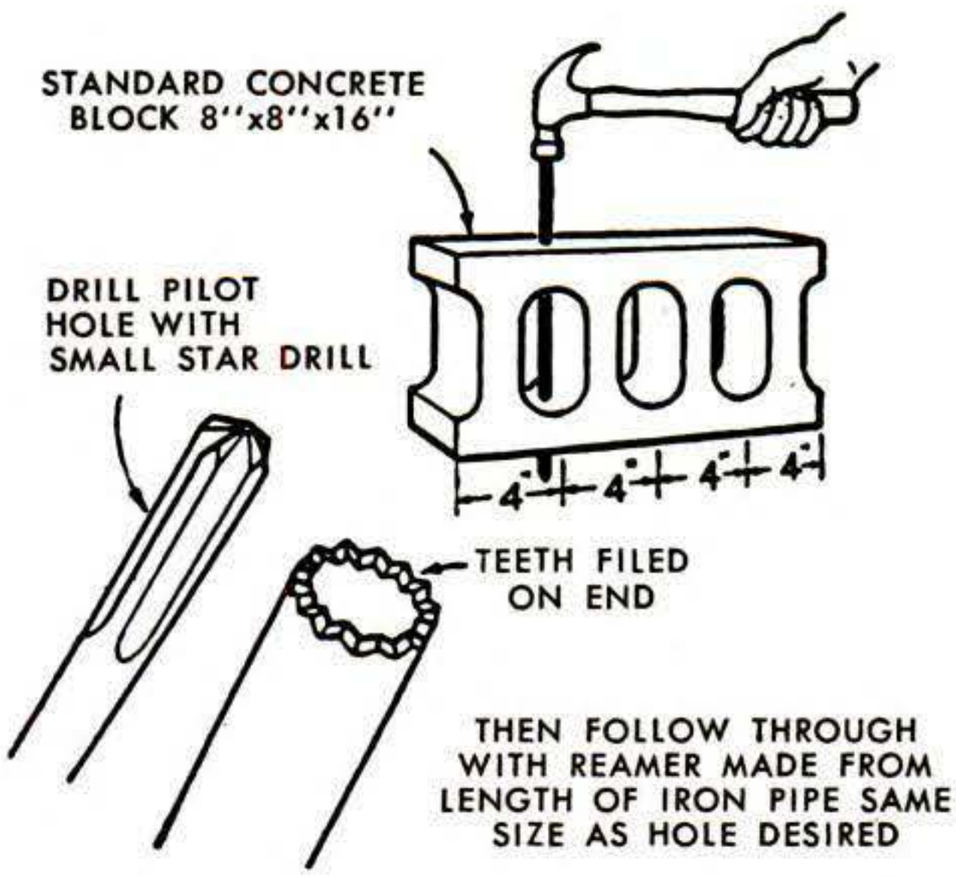
IF YOU carry masking tape in your car, you'll be ready for difficult driving into the sun. Put two pieces across your sunglasses, leaving ⅛" space between. It helps a lot. —*Ken Murray, Colon, Mich.*



Tubing Cutter Snips Dowels

A TUBING cutter will turn out dowel lengths with square, neat and splinterless ends. Tighten the cutter screw with each turn around the dowel.—*Walter E. Burton, Akron, Ohio.*

DRILLING CONCRETE BLOCK



Straight, clean-cut holes can readily be made in concrete-block walls for the installation of water pipes and wiring conduits if the holes are spotted so that the drill will pass through the center of the cores (hollows) in the blocks. This reduces work to a minimum and lessens the risk that the drill will be turned aside by the curved core wall. Cores can be located by measurement once the type of block to be pierced is known. This can often be found by inspecting the foundation or the top of a wall. A common type of block is shown, but others of this size may have a different core arrangement.

Rotate the reamer while driving it.

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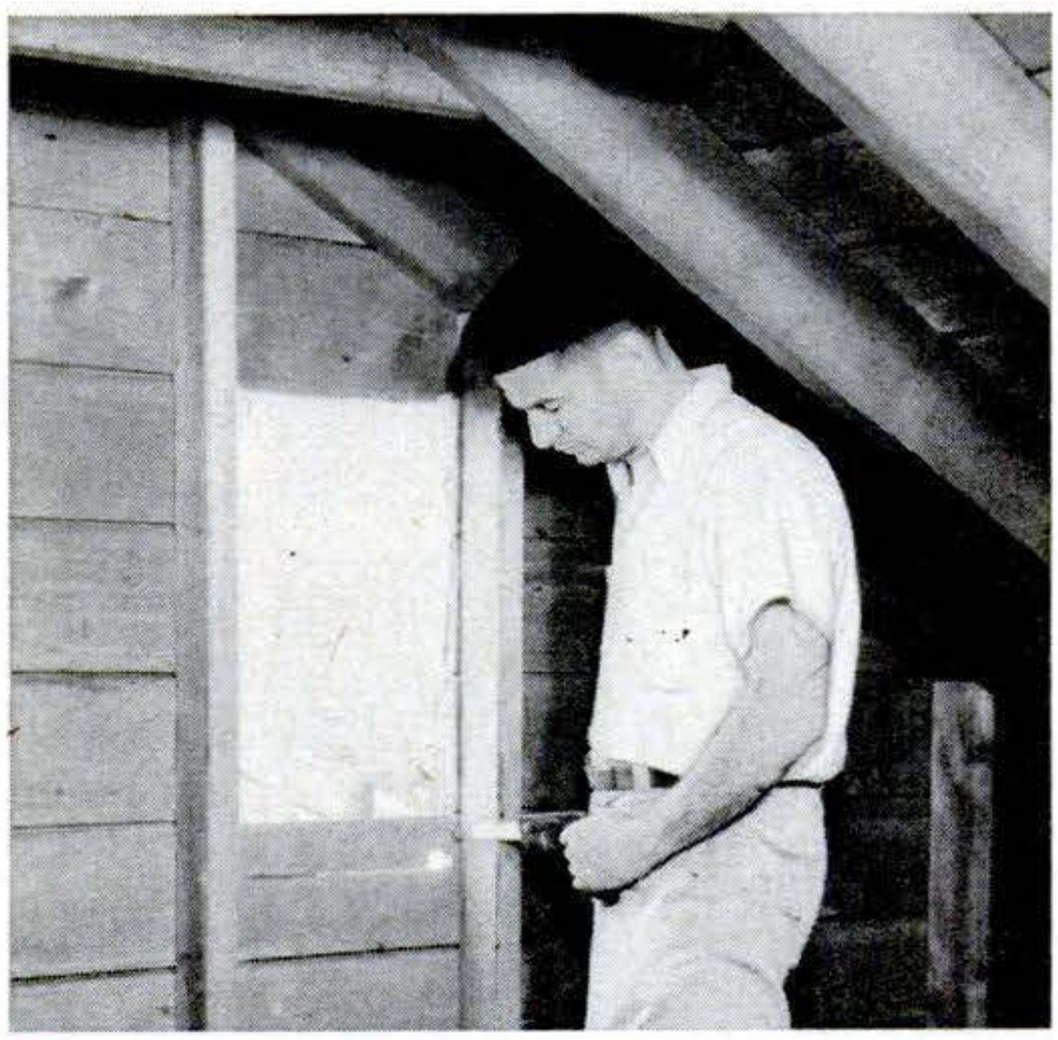
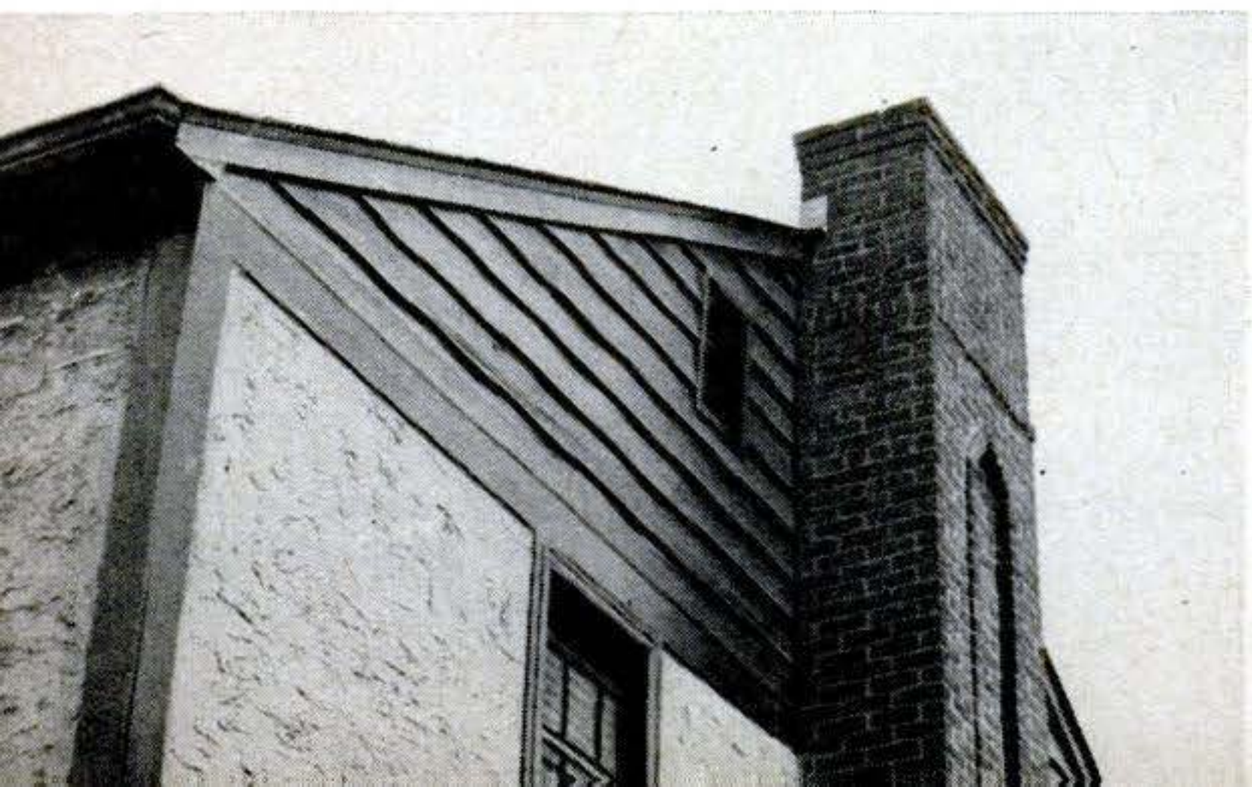
How I Installed My Attic Louvers

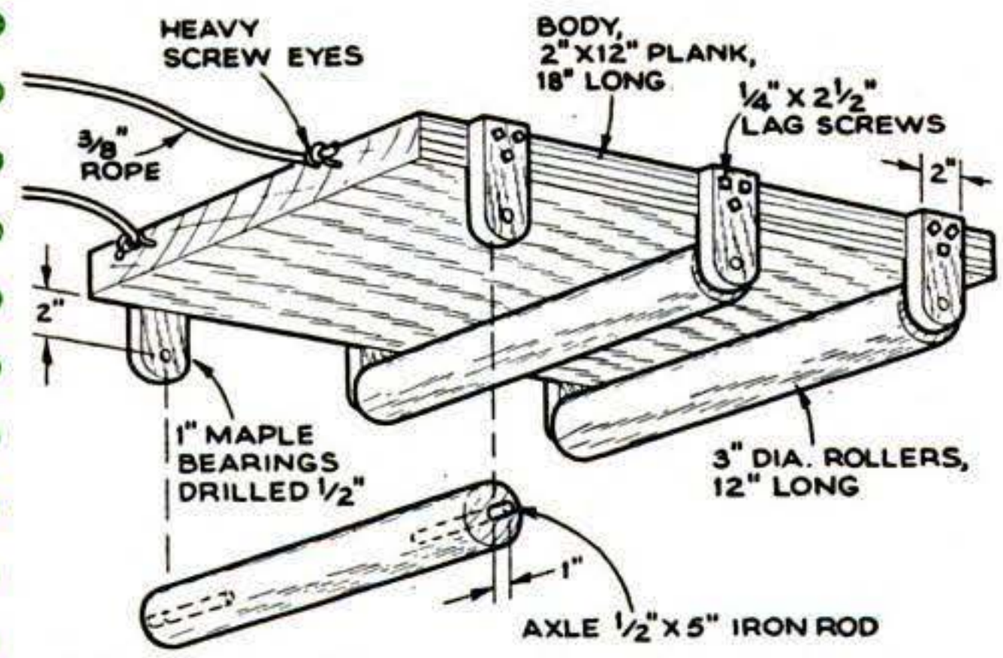
1 THIS ONE-PIECE, screened louver is made to fit between studs. I started by taking outside dimensions of the body and marking them high up on the attic wall.



2 A SERIES OF HOLES bored with a large auger bit let me open the wall with a keyhole and crosscut saw. The opening completed, I angled the louver through, pulled it back into place and nailed it to the studs.

3 THE LOUVER, painted to match the outside house-trim before I started, is inconspicuous and effective. There is a second one on the other side of the chimney.—*Robert Hertzberg, Jackson Heights, N. Y.*





Dolly Rolls on Soft Surfaces

THREE wooden rollers mounted under a thick plank will help you move heavy loads easily—even over lawns and gravel.

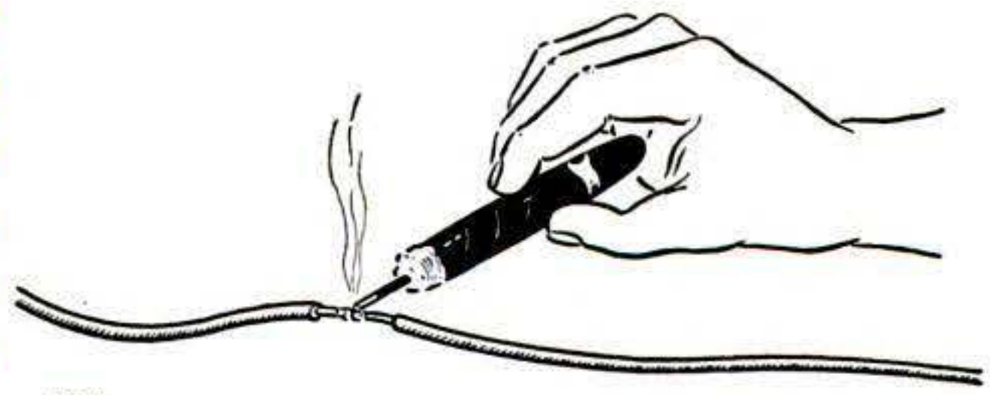
Use rolling pins or 12″ lengths of 3″-diameter solid wood column for the rollers. Drive short lengths of ½″ iron rod into holes bored in their ends for axles. Cut and bore six maple bearings to support the axles and saturate the axle holes with oil for easy rolling.—*T. F. Zimmerman, Beverly, N. J.*

These Pliers Speed Splicing

A SMALL hole drilled in the handle of your pliers will help you make firm, tightly wrapped splices in wire. Make one twist by hand to bring the wires together, then slip the drilled handle over the wire and swing it under and over to form a tight roll.—*Norm Jacky, Fond du Lac, Wis.*

Emergency Soldering Iron

IN A pinch, when electric power or a regular iron is not handy, jab a piece of copper wire into the business end of a cigar for soldering thin wires or small parts. Puff vigorously to keep the copper wire hot. It works and no buts about it. —*Arnold Steckler, Washington, D. C.*



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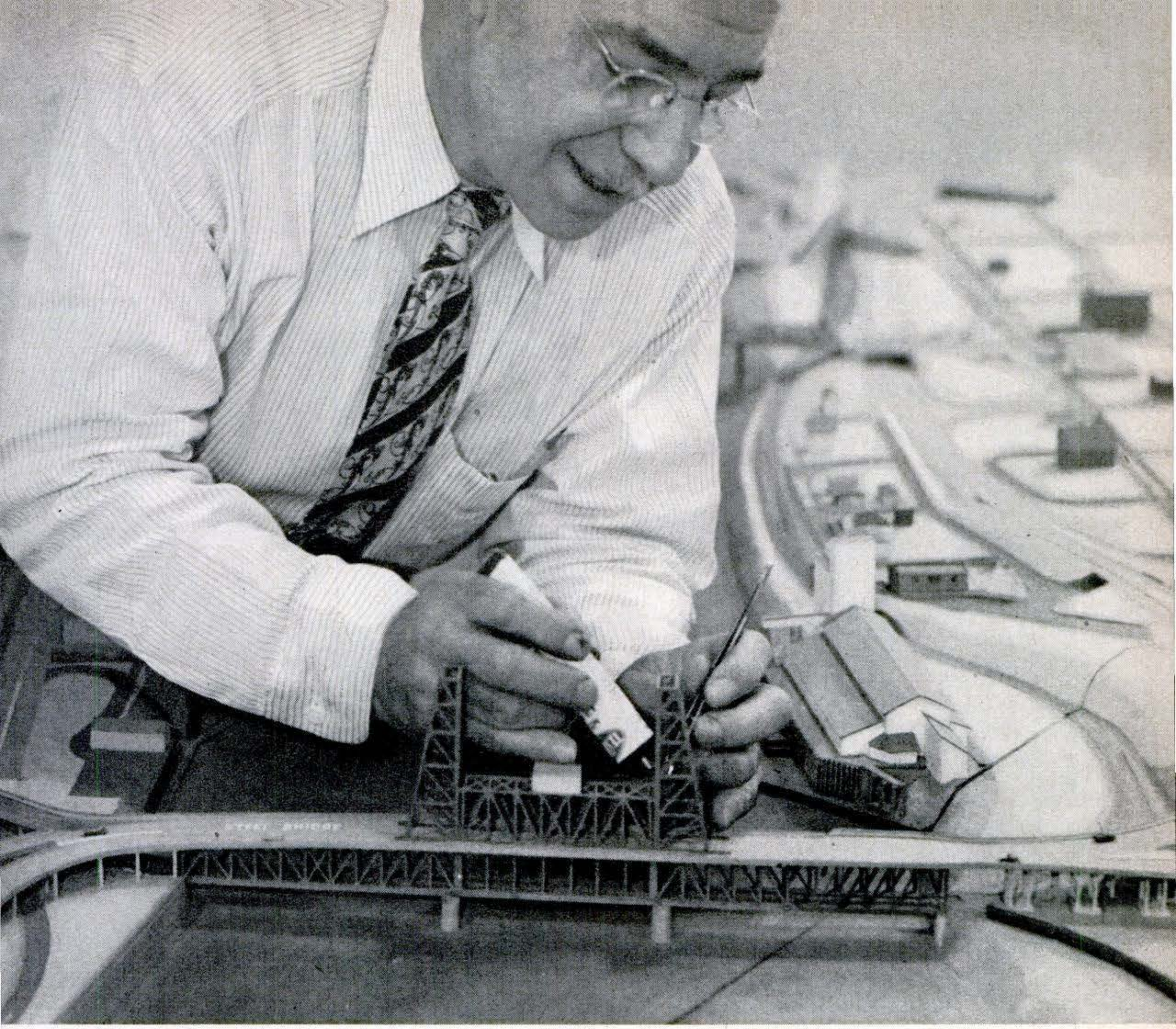

Leaning over his "city," road builder Jim Teed glues in part of bridge superstructure.

Tomorrow's Highways Blueprinted in 3-D

Midget models show Oregon's future roads in such accurate detail that they even stand up as exhibits in court cases.

By E. Milton Grassell

OREGON'S future highways already exist in miniatures. These miniatures, though small in scale, are large in area. Some stretch out 40 feet in the Highway Department's model room in the state capitol at Salem.

Here engineering hieroglyphics are translated into three-dimensional reality complete with buildings, cars, trucks, trains and ships—all so skillfully constructed that from even a short distance away the illusion is startling.

All are precision-built to a scale of 1″ to 50′. The width of super four-lane highways

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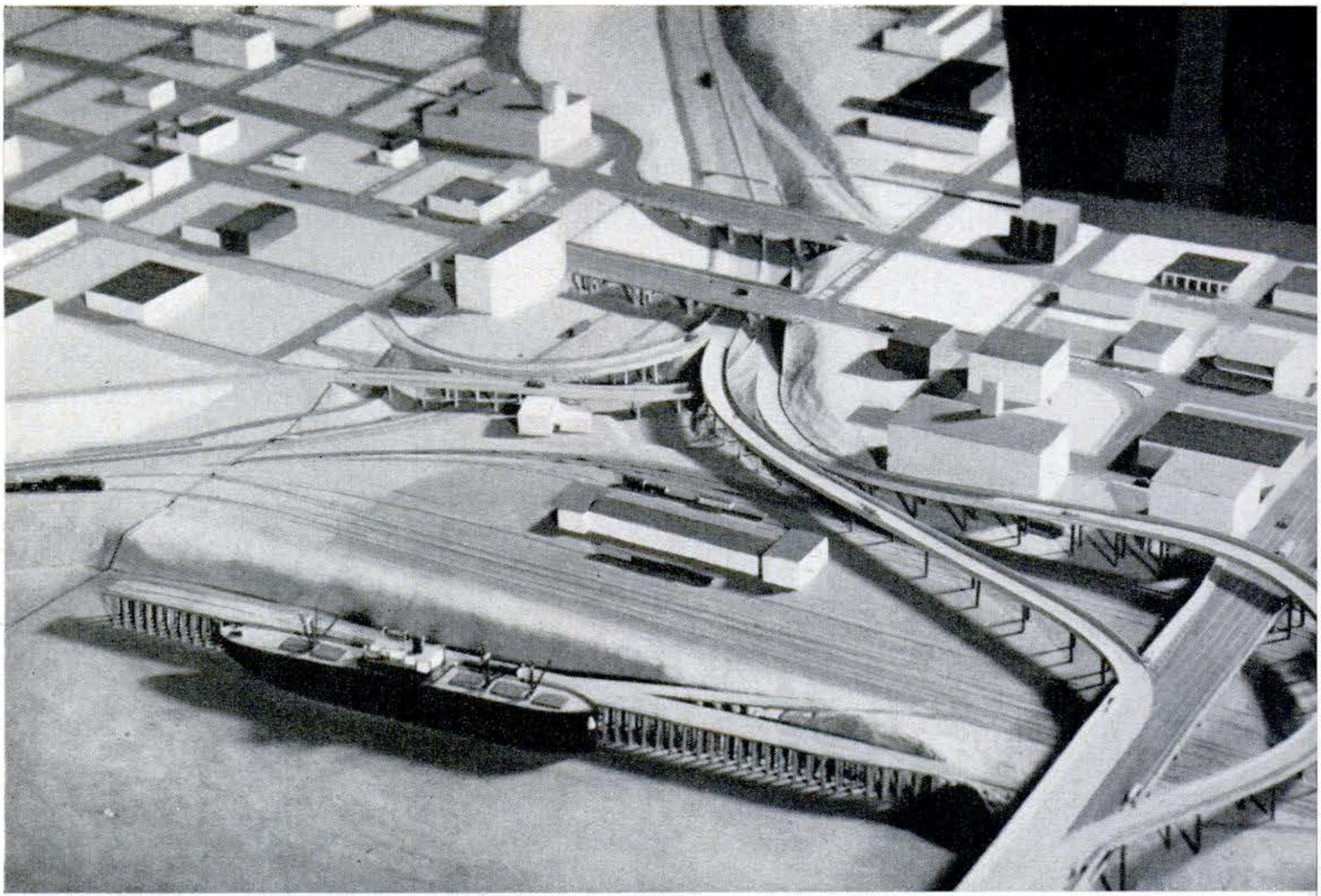

HIGHWAYS AND BYWAYS of Oregon's road system get their start in miniature models like this one. Painstaking details, such as cars, trucks, ships and trains lend realism to the layouts. Business and residential buildings, built to scale, are placed accurately.

is reduced to 1½"; ocean liners are 10" long, passenger cars ⅜".

The superstructure for Portland's proposed Steel Bridge was built from 1/32"-by-1/32" balsa-wood splinters so small that dental forceps—long tweezers—were needed to place the pieces for gluing. Beside these structural pieces a toothpick looks like giant timber.

So delicate was this tiny piece of work that the builder had to hustle to complete it in 10 days.

Tools Are Simple

Model road building in Oregon was started back in the early 1940s by the State Highway Department's chief engineer, R. H. Baldock. Immediately, the models served purposes beyond Baldock's fondest dreams. Six years ago he created a new modelmaking section within the Traffic Engineering Division, under the direction of expert Jim Teed.

Despite the models' minute details, requiring precise workmanship and extreme patience, the tools used to make them can be easily and economically duplicated by the home modelmaker.

One is a knife made from a discarded single-edge razor blade, glued into the kerf of a ½"-by-6" hardwood dowel with model-airplane cement. This handy cutting tool doesn't spread the wood the way an ordinary knife does. It cuts balsa pieces up to ¼" thick.

For cutting arcs and circles, a cutting edge is ground on a pair of 6" sheet-metal dividers. On thicker pieces, the dividers are revolved several times before cutting entirely through.

Airplane glue holds the models together. The highway engineers say a properly clamped glued point is stronger than the original wood. For clamps, they generally use ordinary clothespins.

To translate complicated blueprints into three-dimensional models, the engineers first photograph blueprints showing the plan view. The negatives then are projected to scale in an enlarger, just as regular photo-enlargements are made.

The photoprints are placed directly over

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Tweezers do a big job in building small highways.

• • • • • • • • • • • • • • • •

a ½″ plywood base, and actual construction begins.

When the ground adjacent to the road is uneven, fill is made with crushed paper to about one inch from the surface. Then mineral wood (the kind used for insulation) is spread on and the surface is finished with wood putty.

Everything Is Built to Scale

Rivers, lakes and streams are painted blue, the terrain green; old roads and streets are dark gray. Light gray indicates new traffic routes. An ordinary ruling pen, the kind used in mechanical drawing, is used to line standard traffic lanes in yellow.

Roadside scenery, commercial and domestic buildings, churches, traffic signals and directional indications, cars, trucks, buses and ships—all built to scale—are added to give the model a final cluttered, lifelike touch.

Modelmaking for the Oregon State Highway Commission pays off in many different ways.

Errors in preliminary design that normally wouldn't show up until actual construction at the site got under way are caught in the model room. Minor alterations may improve the design and possibly save the taxpayers some money.

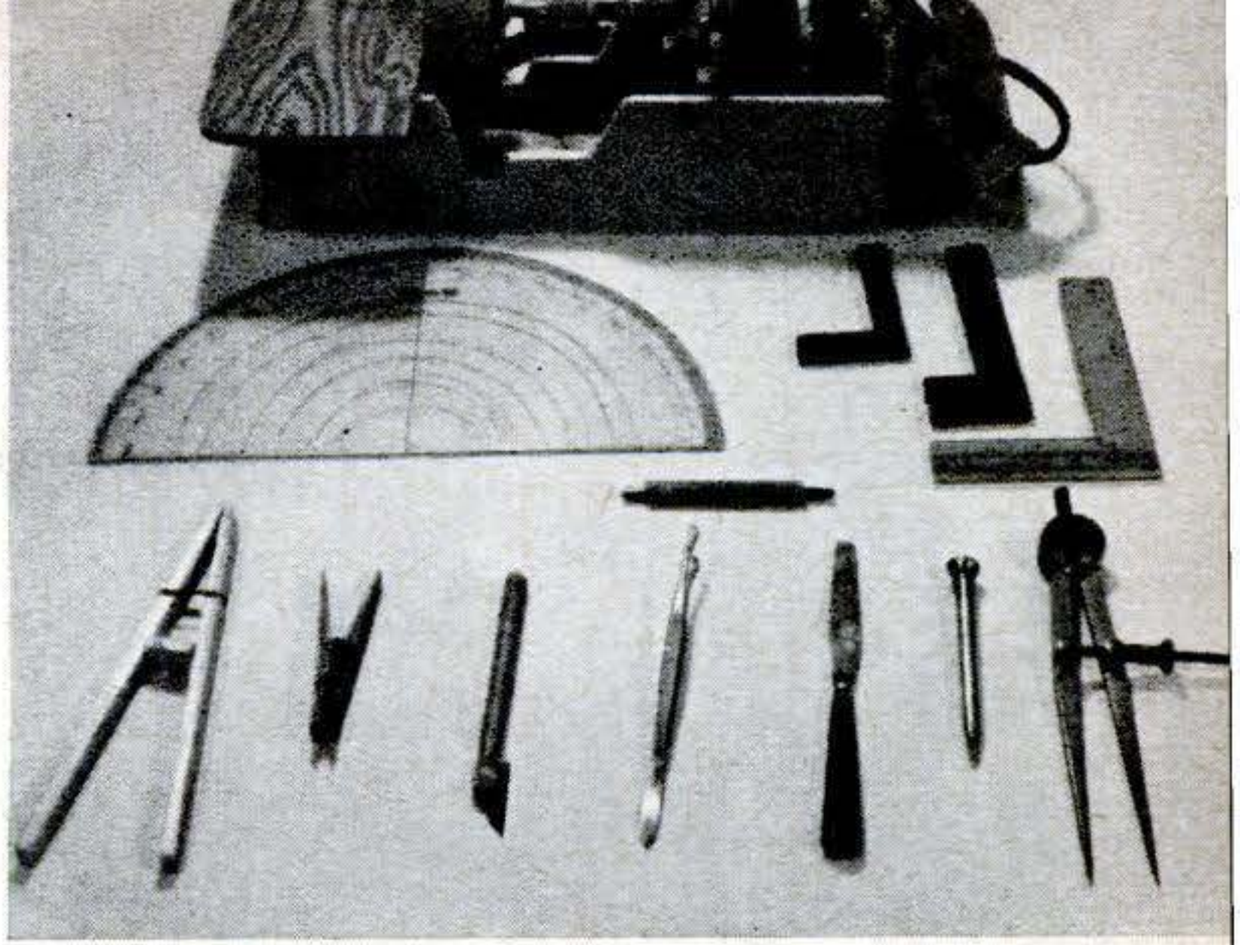
Traffic Engineers Use Models

Landscape engineers also find the models helpful when they want to beautify highways with landscaped dividers or improve the roadside view.

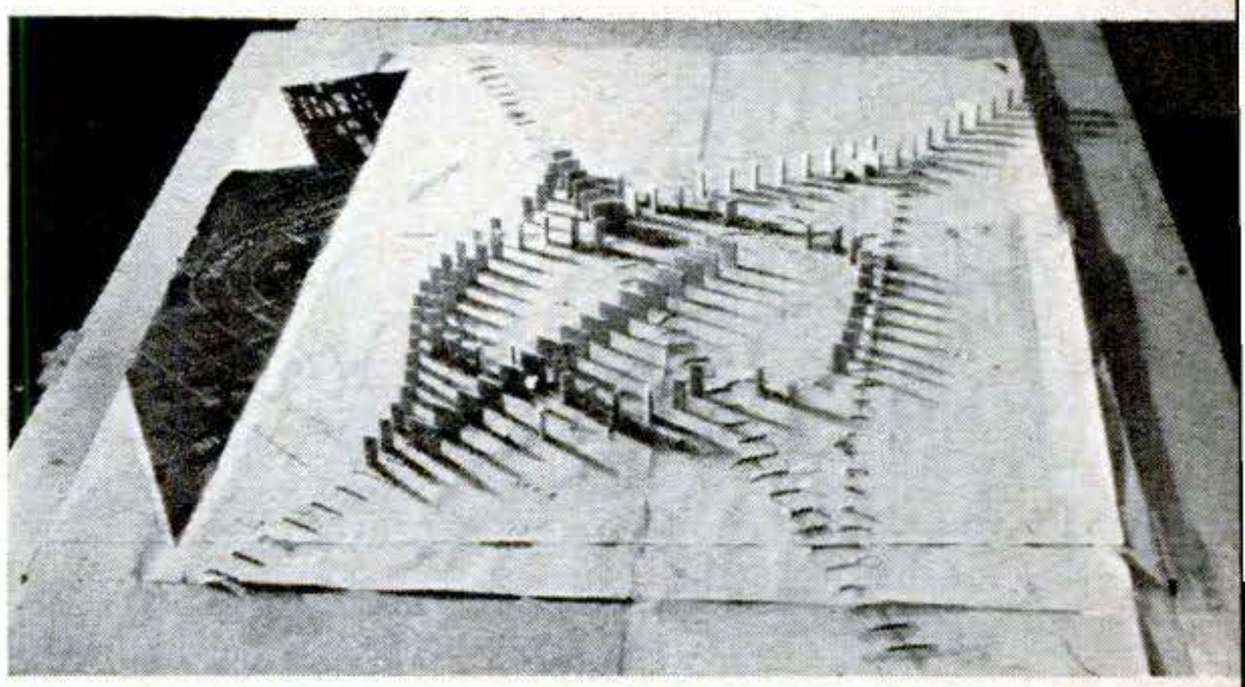
Traffic engineers study the miniatures when routing traffic and placing signals and directional signs.

These miniatures make impressive exhibits at legislative and highway-commission meetings, as school displays, and even in court cases.

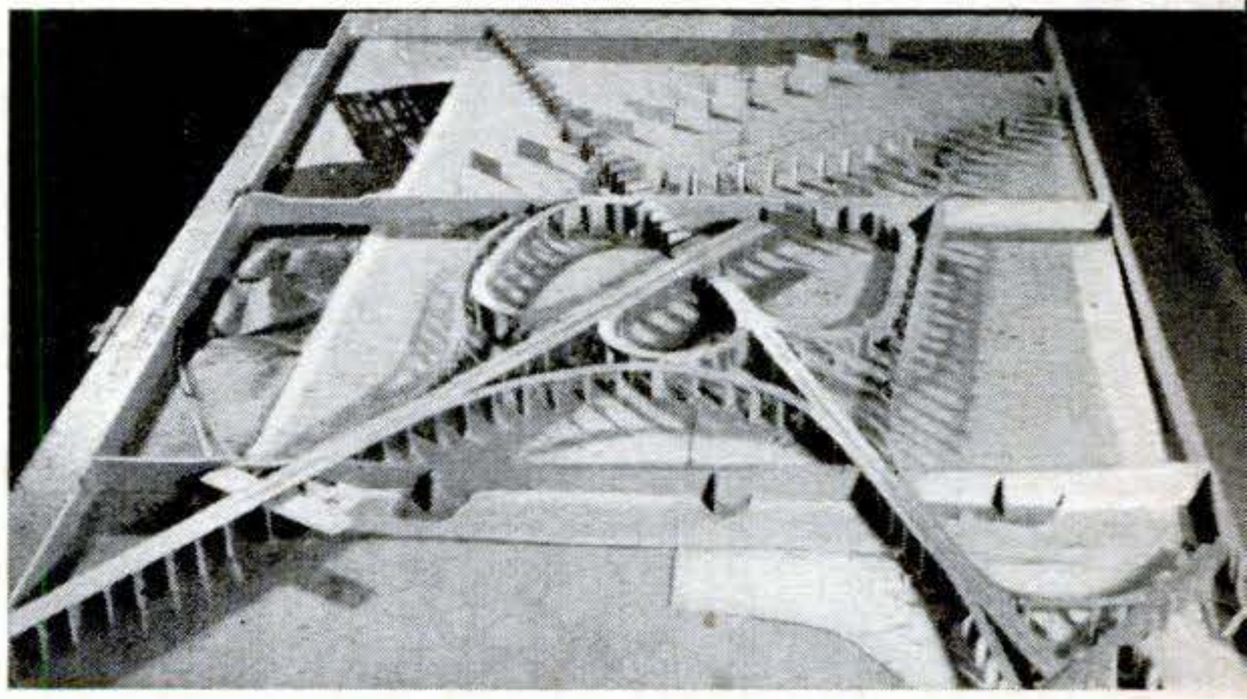
But mistakes can result in spite of all precautions. Take the case of one irritated businessman who demanded an immediate audience with the chief engineer. "Your model isn't accurate!" he exploded. "I have two plate-glass windows in my plumbing shop. Your model shows only one." END



BASIC TOOLS used by Jim Teed in translating engineers' blueprints into three-dimensional models are simple, many of them homemade.

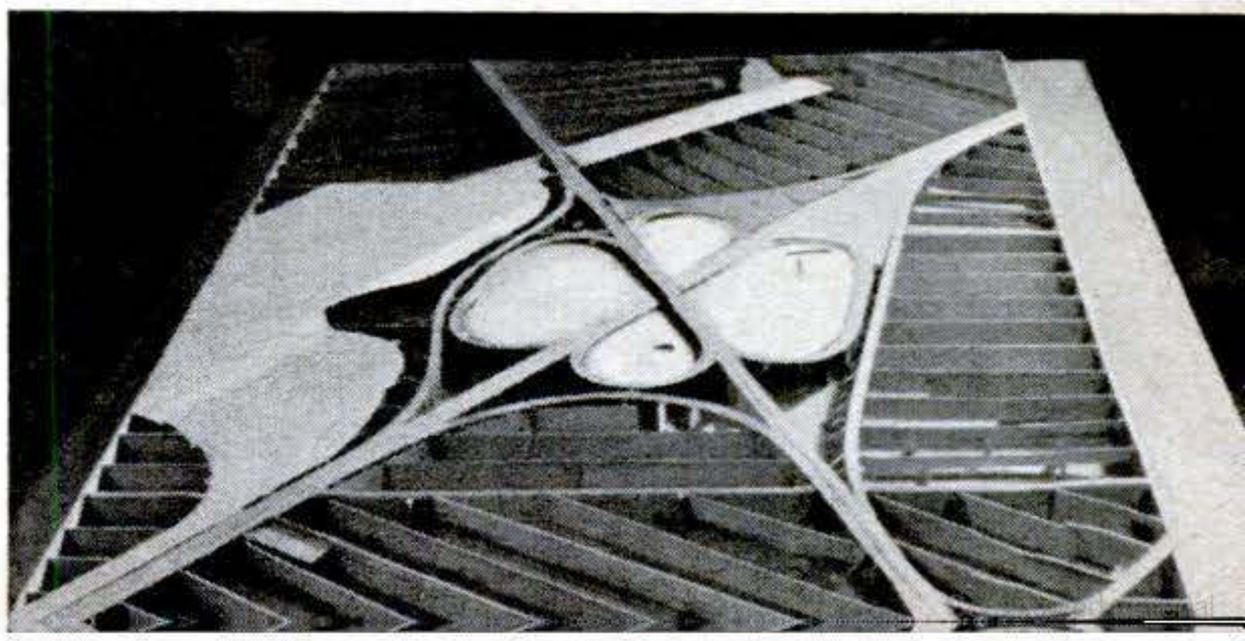


PHOTOENLARGEMENTS of blueprints are laid on a plywood base. Next step is the placing of strips to represent roadbed elevations.



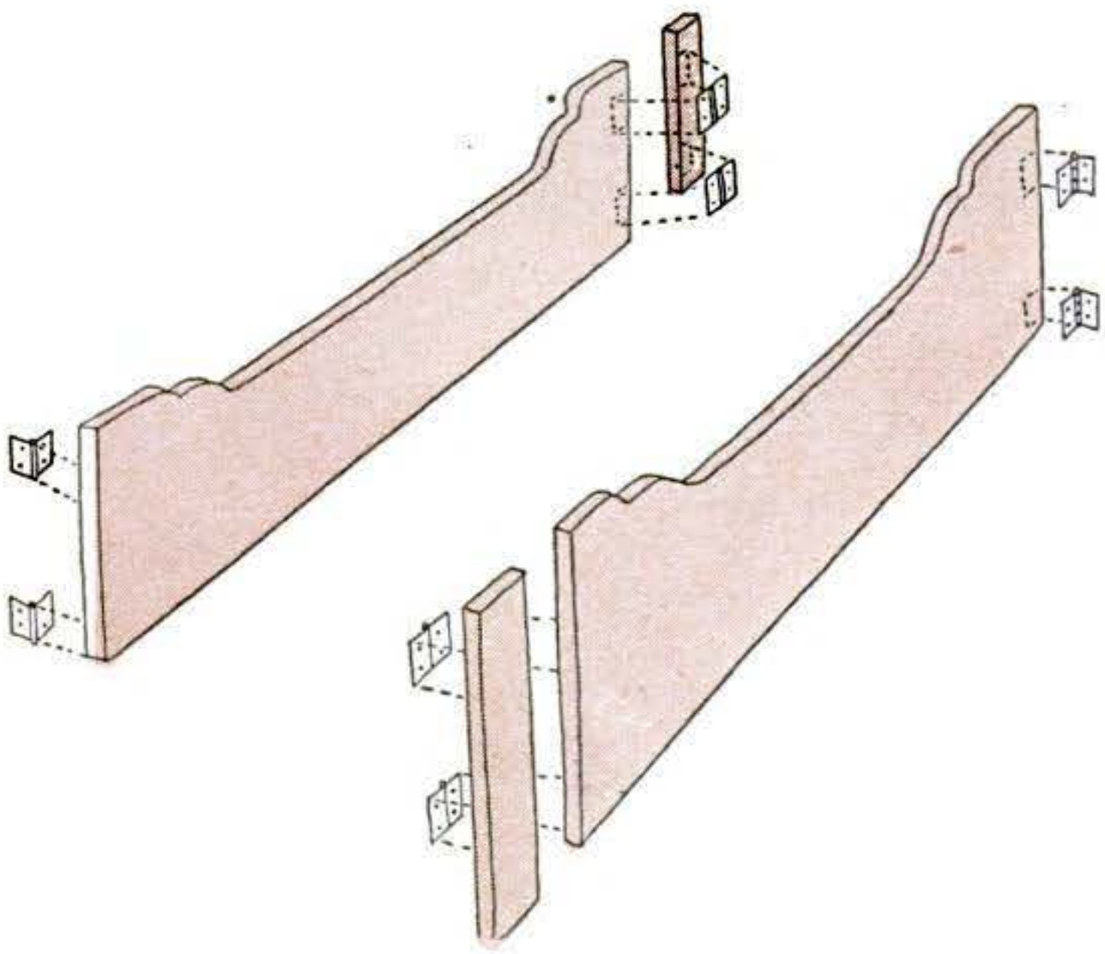
THE MODEL begins to take shape. Strips of wood have been glued to the roadbed elevations to form the finished roads.

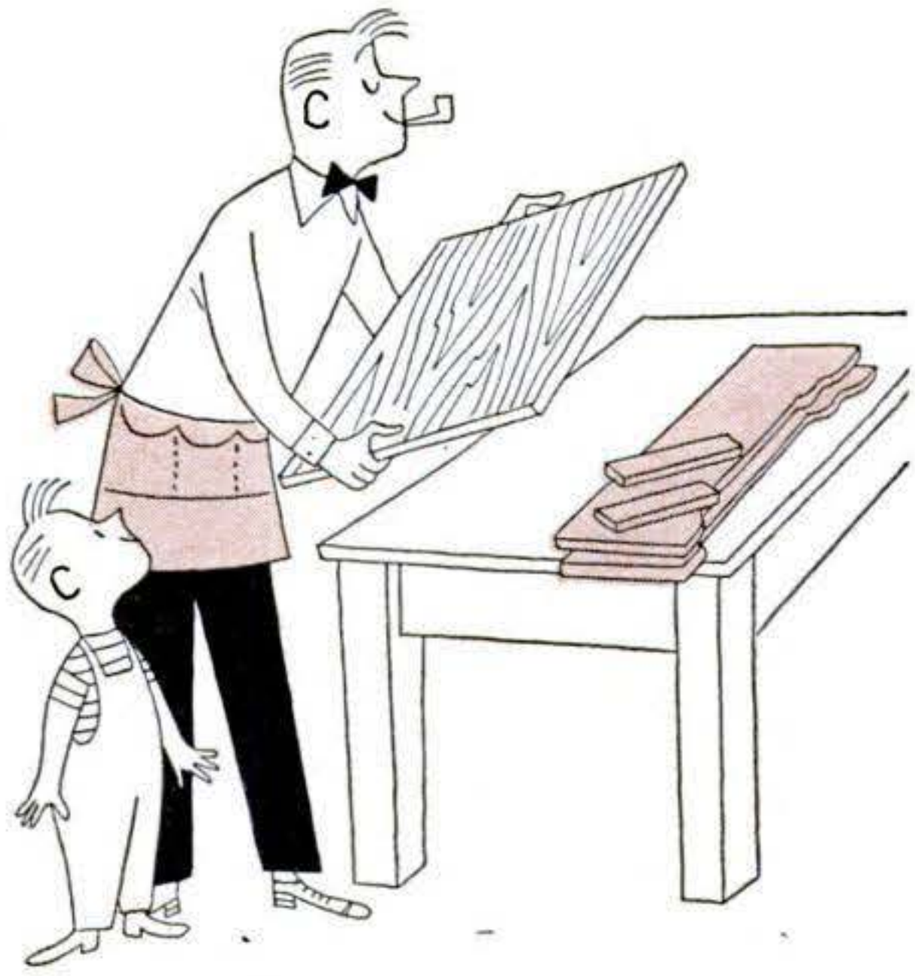
FILLING in of terrain details begins when the highways have been built. Balsa-wood section at left below represents a lake.

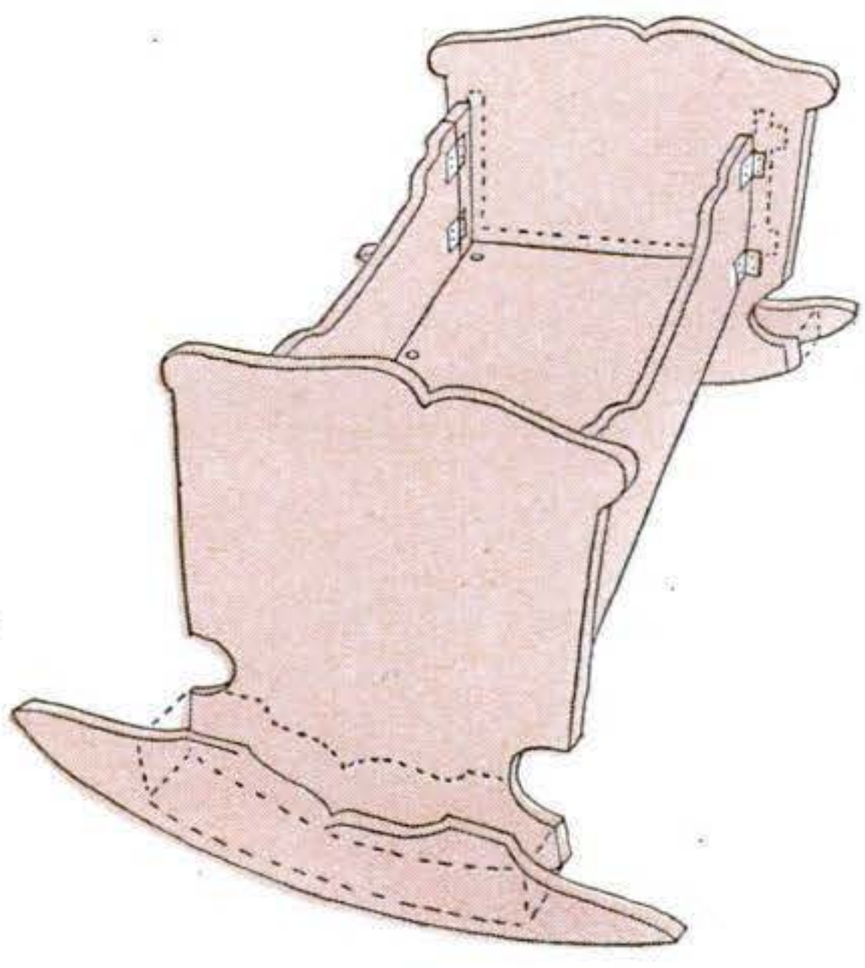


By Roy Doty and Hi Sibley

Wordless Workshop







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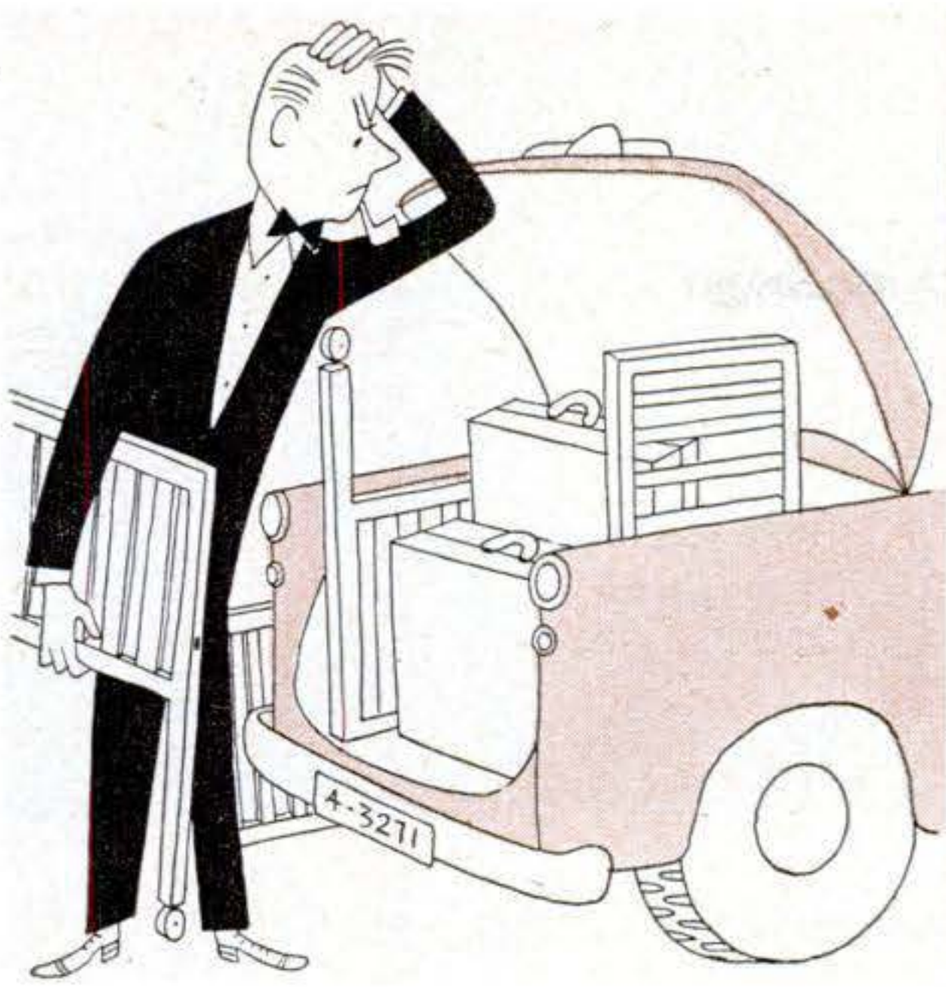

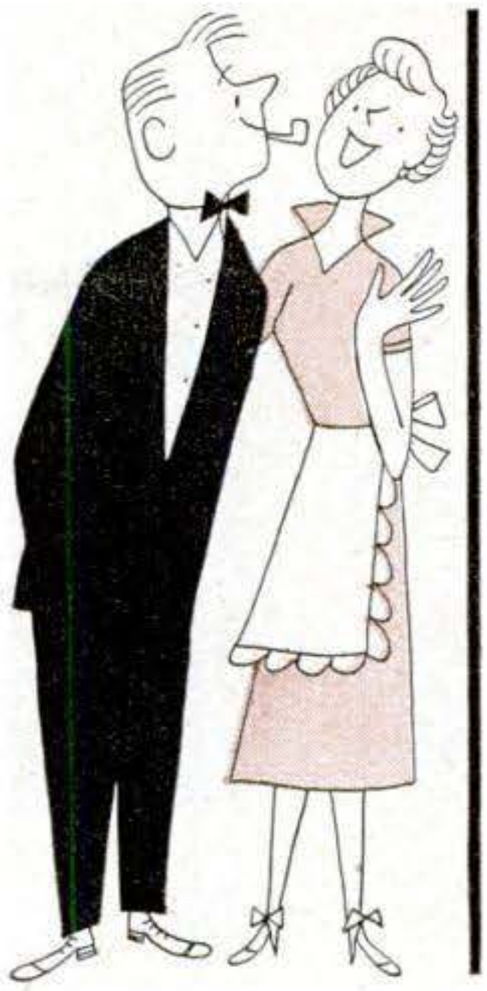

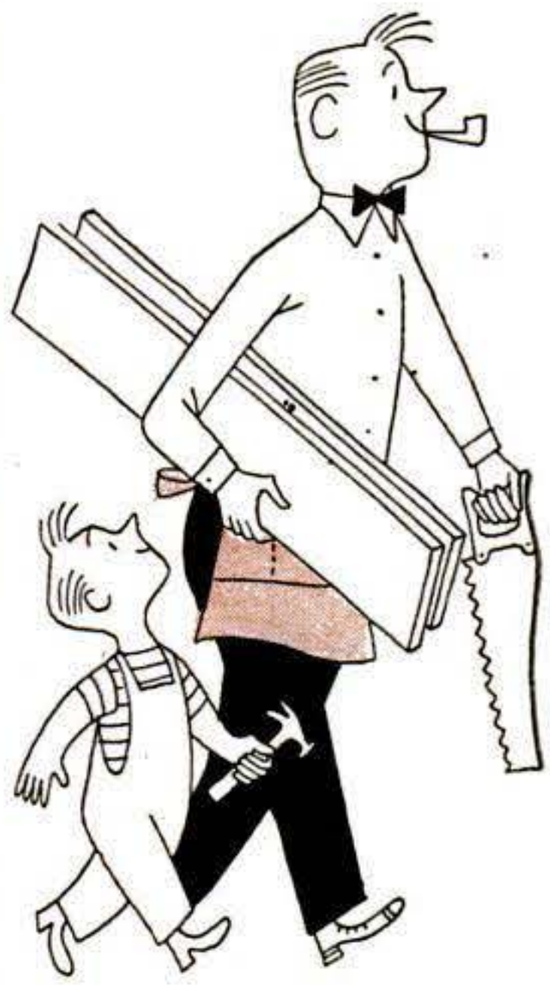

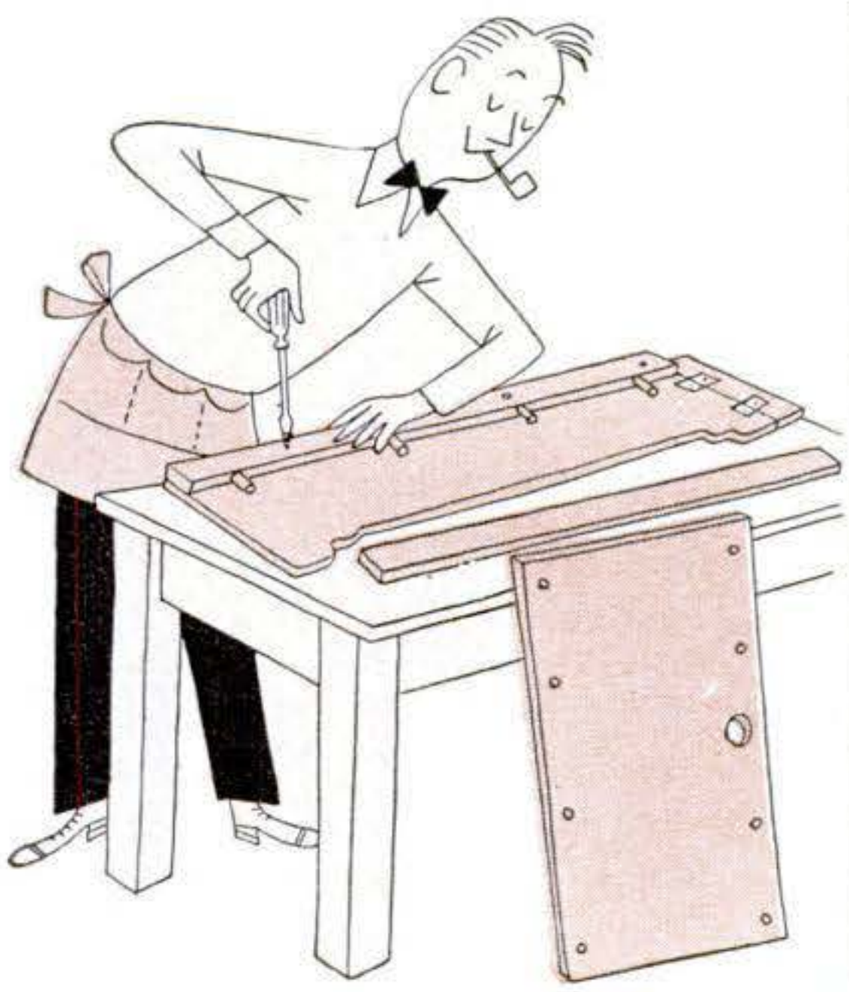

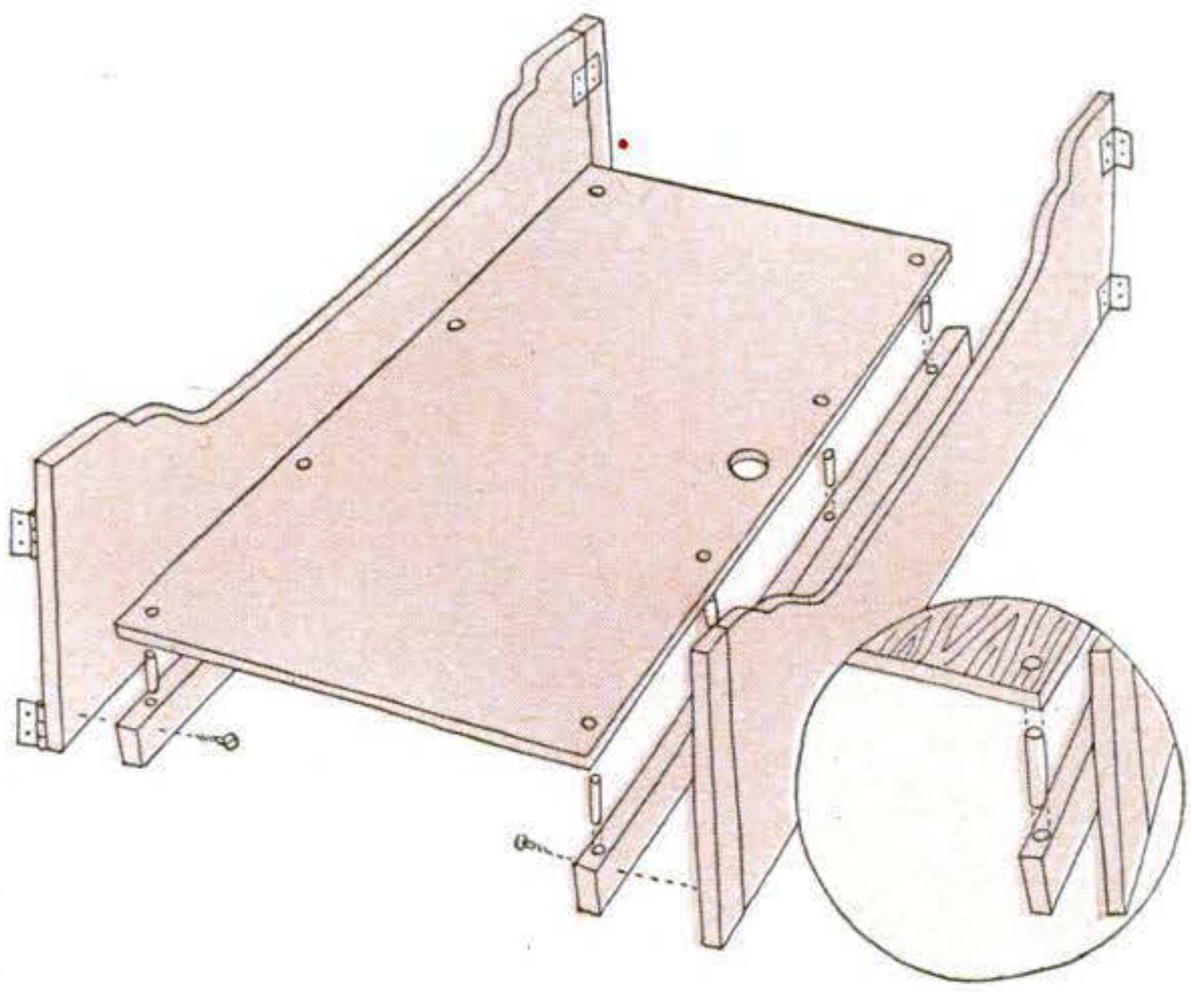

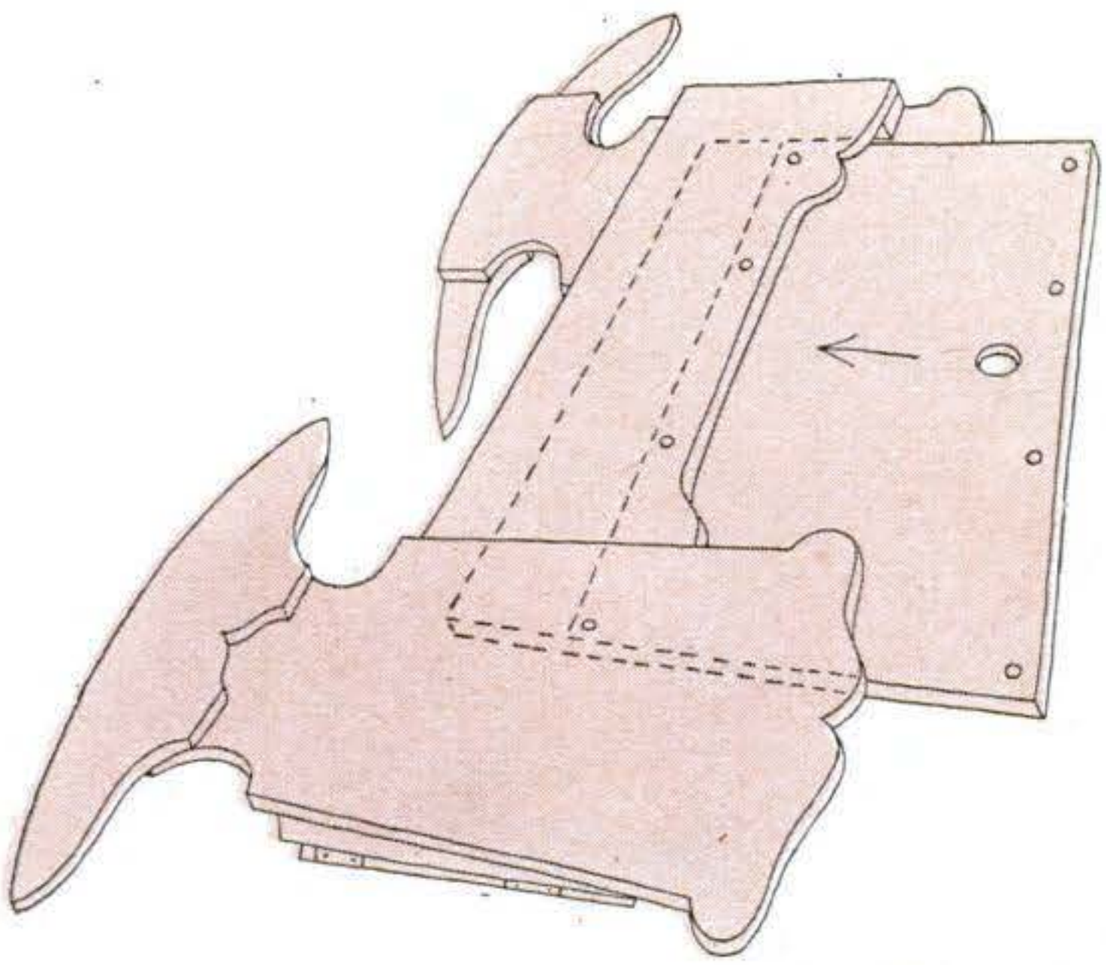

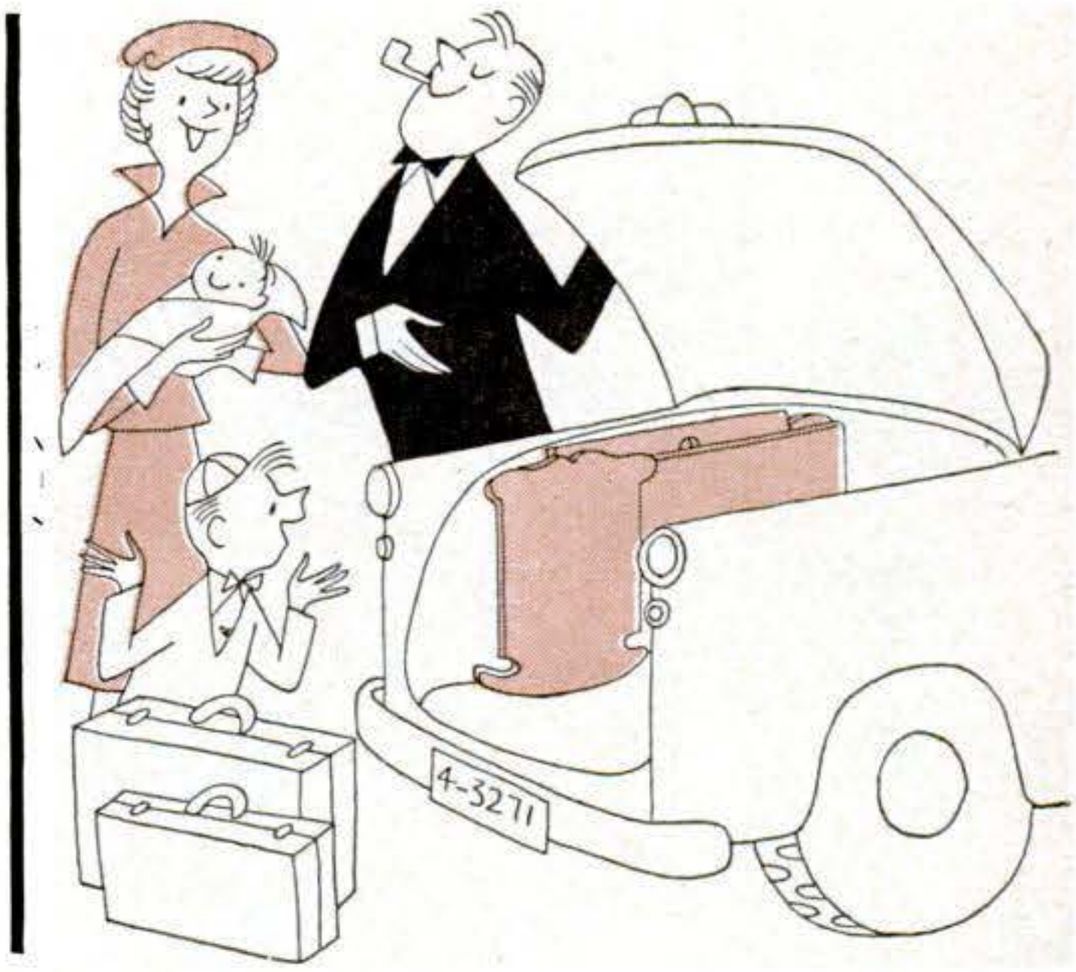

Next Month: A Handy Gardening Tray.

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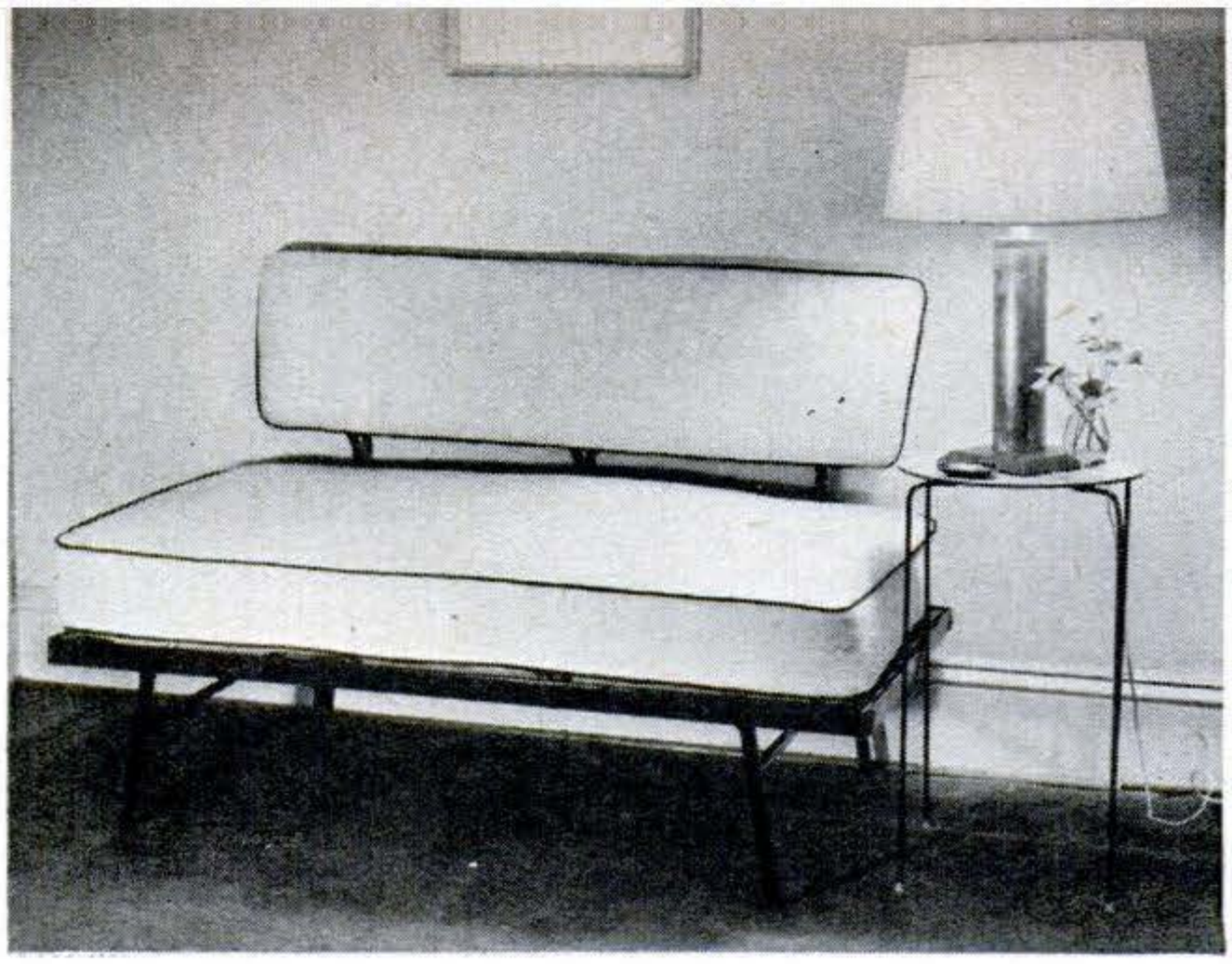
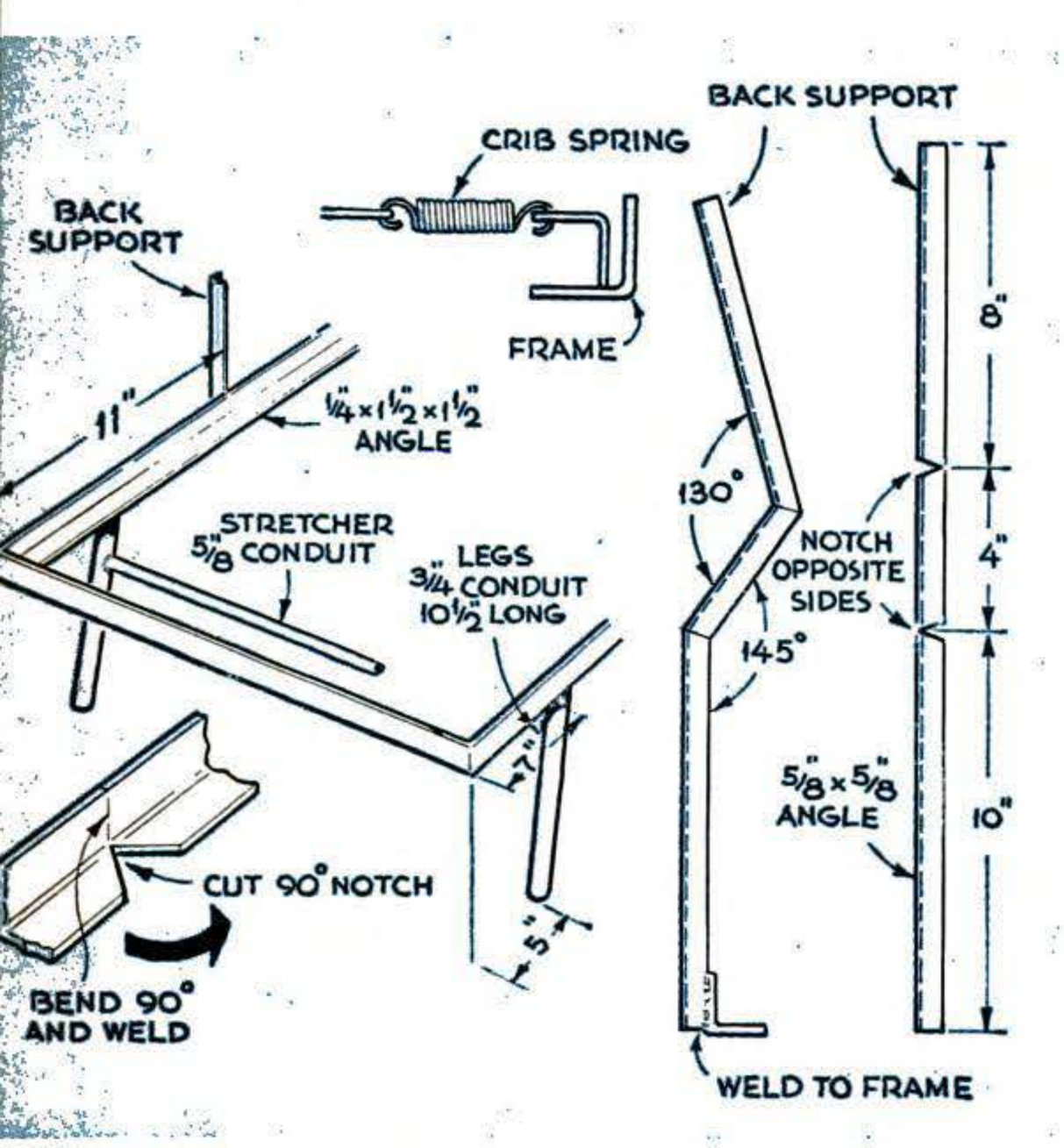
Crib Parts Grow Up Into a Sofa



The simple modern base of this handsome home-salvage job fits in with most of the iron furniture so popular today.



WITH an outgrown crib spring and mattress on hand, this settee can be yours for a fraction of its store value.

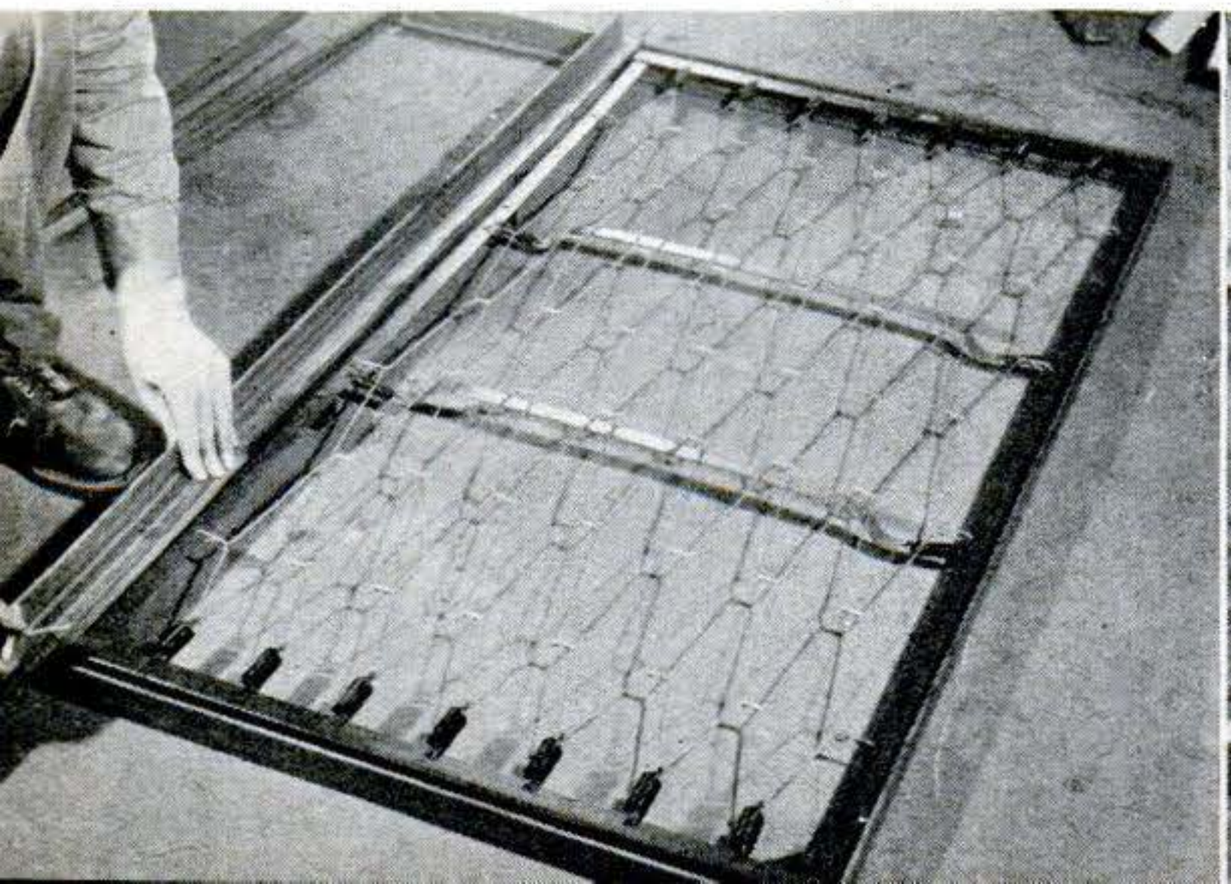
Measure the crib spring and bend a frame of 1½" angle iron to inside dimensions about ½" larger each way. Strengthen the corners by welding across the closed-in edges of the notches. You can have the welding done at moderate cost, if you do not have a welding outfit yourself.

Either pipe or thin-wall conduit will be suitable for the legs and stretchers. The back supports are shaped by notching lighter angle not quite through, and welding at the bends. Weld the supports to the frame and cut a piece of ⅝" plywood so that it fits across them. Wire-brush the metal parts before painting.

Upholster the back with cotton batting, hair or glass-fiber insulating mats. Cover it and the mattress with fabric.

FRAME IS SIZED to an easy fit for the crib spring. One flange of the angle stock is notched and the other bent around to form the front corners. Rear ones are cut 45° and a separate piece is welded across them. The crib rests on the bottom flange of the frame.

WELDS AT CORNERS require about 100 amp. of current. Clamp the straight frame member and the bent one in position for welding the open rear corners as shown. Welding legs and stretchers calls for light current and great care to avoid burning through thin wall.



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A GRADER BLADE is among the tools you can use with a Bolens Ridemaster. The little tractor has a 6-hp. air-cooled engine with a V-belt drive. Each rear wheel can be adjusted vertically, so that you stay level while working along a slope. With a single speed, which gives a 1½-to-3-m.p.h. range, the tractor costs $515. Two forward speeds cost $80 more.

With the new baby tractors you can do your

Gardening from the Saddle

Today's range of sizes and accessory tools will handle almost anything, from a half-acre crabgrass ranch to a weekend farm.

By Hartley E. Howe

ANYONE with a good-sized hall closet can keep a tractor now. The giants of the wheat farms and cotton ranches have baby brothers that take up no more room than a big express wagon. Yet these midgets are sturdy enough to push mowers, pull grass rollers, haul carts loaded with tools or fertilizer, and even push light snowplows.

These very small machines are primarily for lawn care. If you want more work capacity, there are somewhat larger riding models with a real tractor look and feel about them, even though they are no bigger than a motorcycle and sidecar. Scaled to their size are a long line of farm and tractor tools, so that these work ponies can do many of the jobs of the big fellow—pull a plow through heavy loam, spray six rows of vegetables, scoop out the dirt for a wading pool. In fact, one maker claims his baby

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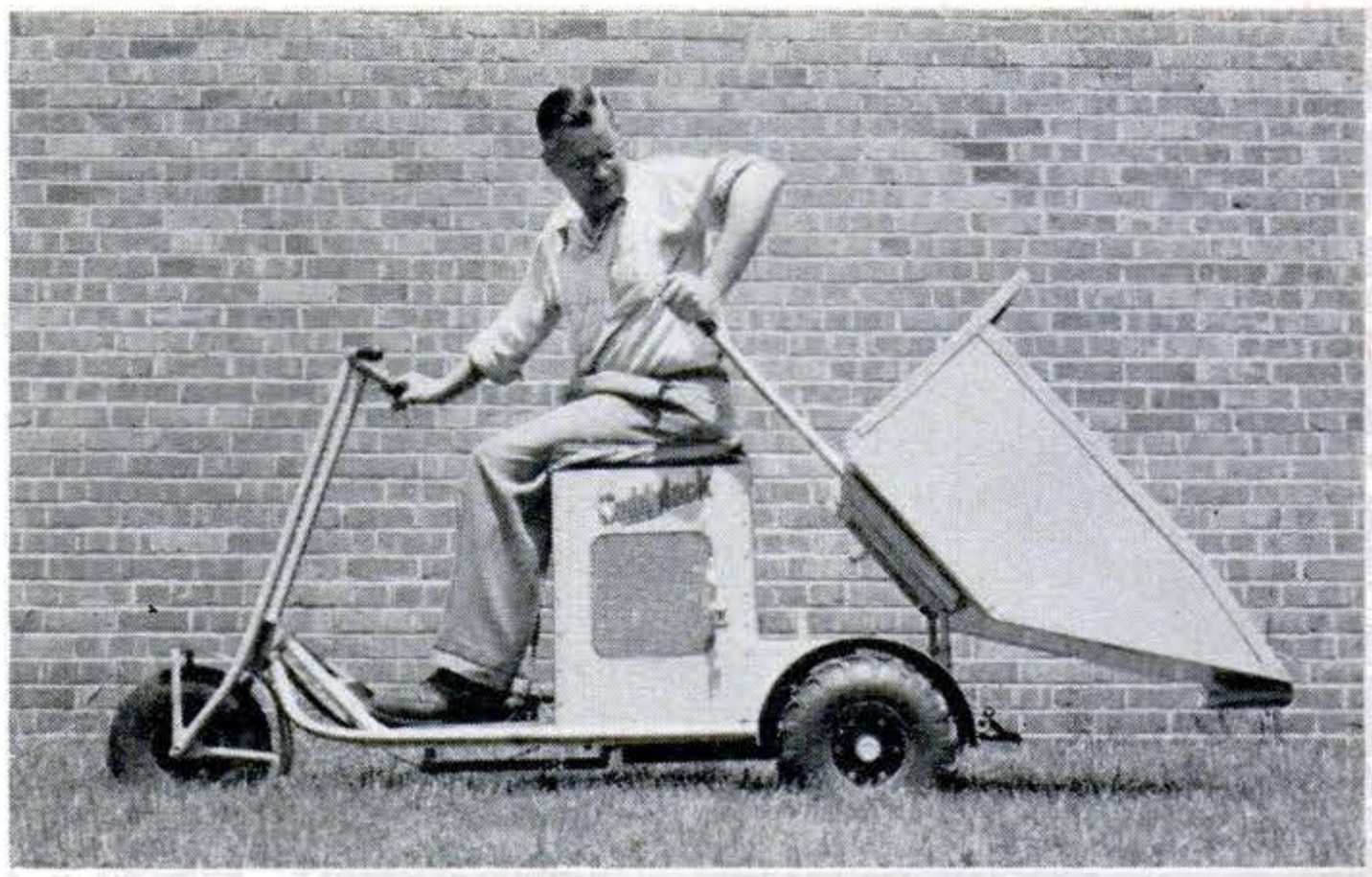
These light tractors run on three wheels



FROM GOLF TO GRAVEL is the history of this three-wheel tractor. The Caddylack was designed originally by the Dero Corp. as a mechanized caddy. Made in both gasoline and electric models, its job was to carry two men and two golf bags around the links. Now it has been modified into a yard tractor with a built-in dump truck. The hopper carries half a yard of material.

SUNDOWN FARMERS—some 2,000,000 factory or office workers who do their farming after work and on weekends—form the market at which the Bradley Tri-Trac is aimed. Sears, Roebuck is distributing the little workhorse, which has its own line of 12 accessory tools including a dump rake and a planter. Powered by a 6.1-hp. engine, the three-wheeler is designed to plow, plant, cultivate, mow, and plow snow. It turns on an 8′ radius. The wheelbase is 68¾″; the front-axle spread can be adjusted from 48″ to 72″ at 2″ intervals. There is about a 2-m.p.h. range of speed without clutching in both forward and reverse, done by a quick-change lever working off the adjustable jackshaft belt. Without accessories, the tractor sells for $598.

will do all the work on a 10-acre farm.

The prices for back-yard tractors vary pretty much according to the horsepower. The very smallest mower jobs start around $200. Big fellows over eight horsepower can cost as much as $700. By the time you get up to these sizes, you are nudging the smallest of the regular farm tractors, such as the 9¾-horsepower Farmall Cub.

Anyone buying one of these tractors is going to have to face up to the small-boy problem. A miniature tractor attracts kids like a personal appearance of Captain Video. If there is any chance of a boy talking himself into a driver's job, you may want to consider modifying the throttle with a spring return, which automatically slows the engine to idling speed if the driver takes his finger off the button. This keeps the tractor from running away with a small boy. A basic driver's course is indicated for any young operators, with plenty of supervision. And in any case, with kids around you'll want to check on your stopping time—not all tractors are equipped with brakes.

The familiar walking tractors are getting into the riding act, too. The bigger ones can now be bought with riding sulkies, so that they will haul you around the yard. Of course the real target of all this is Pop, the man whose motto is never to stand up when he can sit, and never to sit when he can lie down. The tractor builders still haven't turned out a combination garden cultivator and lawn lounge, but they are probably working on it. I'm putting my order in for the model with the foam-rubber mattress, FM radio and a good reading light. It should be along any day now.

Further information about the tractors pictured can be obtained from: Bolens Products Division, Port Washington, Wis.; Dero Corp., Church and Elm Sts., Willoughby, Ohio; Sears, Roebuck and Co., 925 South Homan Ave., Chicago 7; National Farm Equipment Co., 142 Greene St., NYC 12; Cheston L. Eshelman Co., 119 Light St., Baltimore 2, Md.; Musgrave Mfg. Co., Springfield, Ohio; Ride-A-Mower Co., 305 Knowlton St., Bridgeport 8, Conn.; Pioneer Mfg. Co., 1910 South 81st St., Milwaukee 14, Wis.; Tiger Tractor Corp., East and Mozelle Sts., Keyser, W. Va.; Garden-All Tractor, Liberty, Ind.; Red-E Tractor Co., Richfield, Wis.

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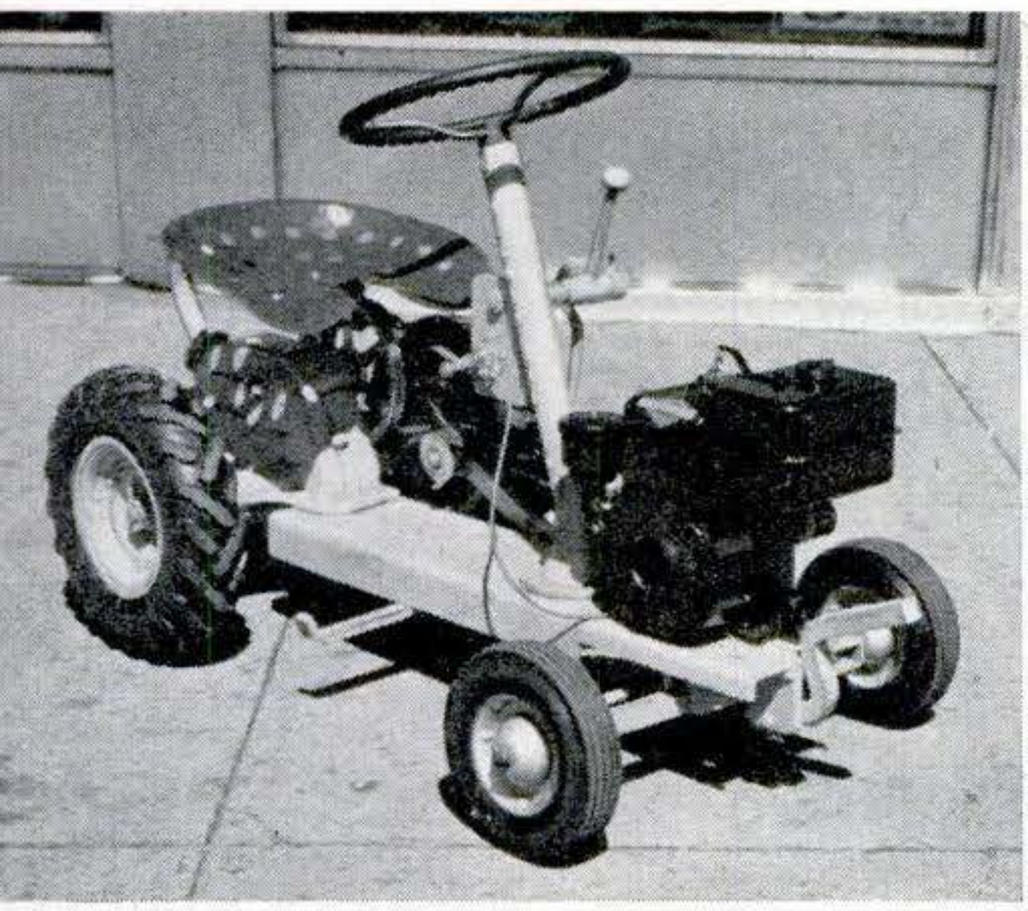

These tractors are the little jobs

A THREE-HORSEPOWER, air-cooled engine drives the Mascot at right, which lists at $225. National Farm Equipment Co., the maker, claims it can pull a 3,000-lb. load on wheels. Highly maneuverable, the machine is 64″ long, 28″ wide. Besides the cutting reel shown, implements available include plows and harrows.

HITCHES, front and rear, raise and lower on the Eshelman, above, to allow attachments to be slid on or off without the use of tools. The 3-hp. engine has forward and reverse speeds, the power being transmitted by a roller chain from the engine to the gear-reduction unit. This model, 48″ over-all, 26″ high and 22″ wide, costs $279.50. More powerful models cost up to $595. Accessories include a buzz saw and a 1,000-watt generator.

These riding mowers are specialists in lawn care

A ROTARY CUTTER whirls under you when you ride the Mow-Cycle, but it can haul a light roller or cart. The 3-hp. riding mower, which has a clutch and hand throttle, has a 5-m.p.h. top speed. Weighing 198 lb. the little machine is 46″ long, 26″ wide. Made by Musgrave, the Mow-Cycle sells for $274.50, the 2-hp. Lawn-Cycle for $199.50.

CUTTING GRASS is this baby's basic job. Only 49¾″ long and 24″ wide, Ride-A-Mower has both forward and reverse, can pull a cart or push a light snowplow. The 2-hp. tractor with built-in rotary cutter costs about $265. A 3-hp. model, without the cutter, and made to take a reel mower ($100), costs the same. Accessories include a lawn sweeper.

Please turn the page for more tractor photos.

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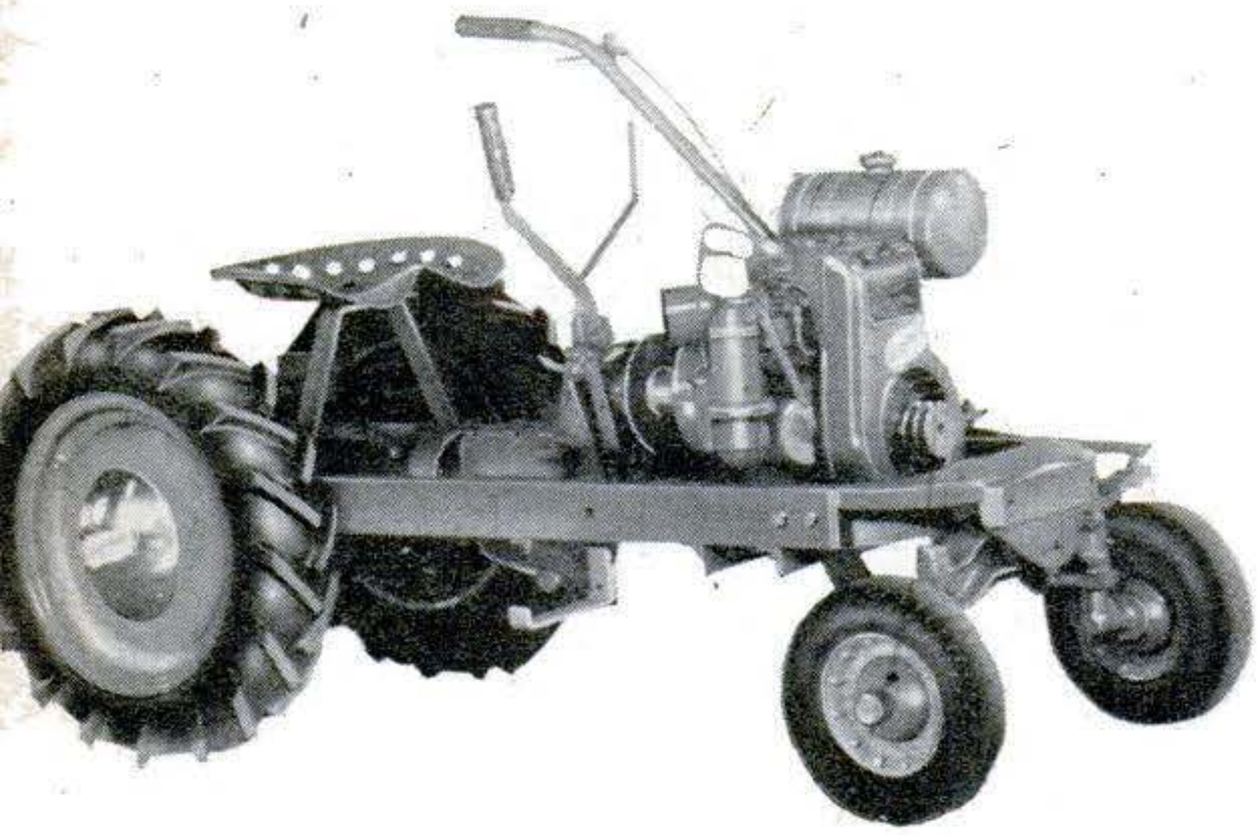
These middleweights are garden work ponies

REAR ENGINE puts the weight over the drive wheels of the 6-hp. Page above—and also gives the operator a clear view of attachments that fit under the frame between the front and rear wheels. Top speed is a little under 4 m.p.h. This tractor costs $540; the maker, Pioneer, also turns out a model with an electric-starter unit.

A COMPACT TRANSMISSION, with a clutch, gear reduction, neutral, forward and reverse all in one unit, is featured in the 5¼-hp. Tiger. The tractor can haul 4 tons, pull a 10″ plow through sod, or plow 18″ of wet snow. With a 5-m.p.h. top speed, the Tiger burns an average of 2½ gallons in 8 hours' work. The model shown above in use with a grader has double rear wheels, an extra. The 5¼-hp. model costs $465; an 8-hp. job, $21.50 more.



A TILLER steers the economy model of the 6-hp. Gard'n Mast'r, left. It has a Chrysler transmission, three forward speeds and reverse, costs $475. Garden-All Tractors also makes models with steering wheels, brakes and larger engine—priced up to $210 more.

The biggest garden tractors can work a small farm

FOUR TONS is the pulling load claimed for the Red-E at left. One of the largest of the midgets, the tractor is 84″ long, 48″ wide, weighs 770 lb., has an 8¼-hp. engine with Borg-Warner transmission and belt-power take-off. There are three speeds forward and a reverse. The tractor alone lists for $700. Attachments run from about $30 to more than $400. END

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For a modern note in your bathroom, build in this

Legless Dressing Table

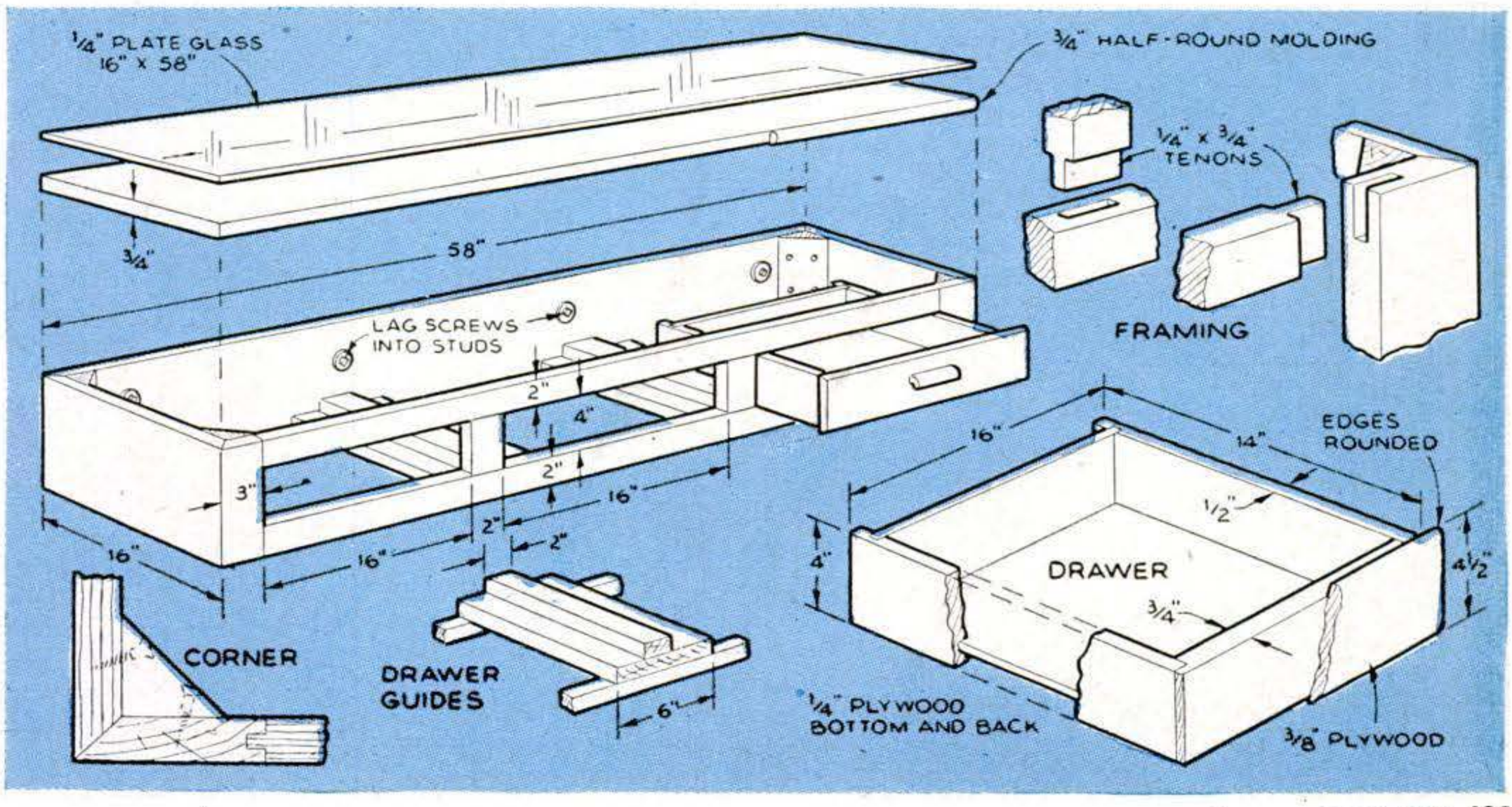
Bolted to the wall studs, it adds a lot of storage space.

IF THERE isn't enough space in your bathroom for this good-looking shelf-table, you can make it fit by building only two drawers instead of three. Even a single-drawer shelf is useful in a small room.

Use ¾″ pine for the sides, back and front rails. Miter the ends and join them with glue reinforced by corner blocks and screws. Assemble the front rails and drawer separators with glued mortise-and-tenon joints and nail the drawer guides in place. Edge-glue two 58″ lengths of ¾″-by-8″ pine to make the top, 16″ by 58″, then glue this over the shelf frame. Nail ¾″ half-round molding around the top to conceal the edges.

Make the drawers for an easy fit in the openings and glue a false front of ⅜″ plywood on the face of each. Cut these pieces ½″ wider and ½″ longer than each of the drawer openings so they will overlap ¼″.

Drill ¼″ holes through the back of the shelf in line with the studs and hang it with ¼″ lag screws. Enamel it to blend with the bathroom colors. Add decorative handles and have a piece of ¼″ plate glass cut to fit over the top. A mirror hung on the wall will make the shelf a convenient dressing table.—*Hi Sibley, Nuevo, Calif.*



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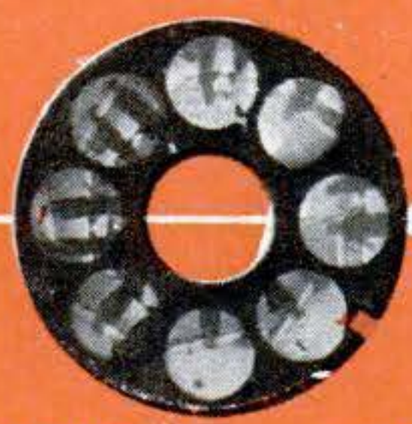
Here's how to have fun with

Cameras



WHO'S GOING TO NOTICE a casual lounger checking his watch? Not the two characters above. Pass the papers, quick! But that wasn't a watch—it was a wrist camera. And Secret Agent XX got the picture at right, enlarged from the tiny contact above.

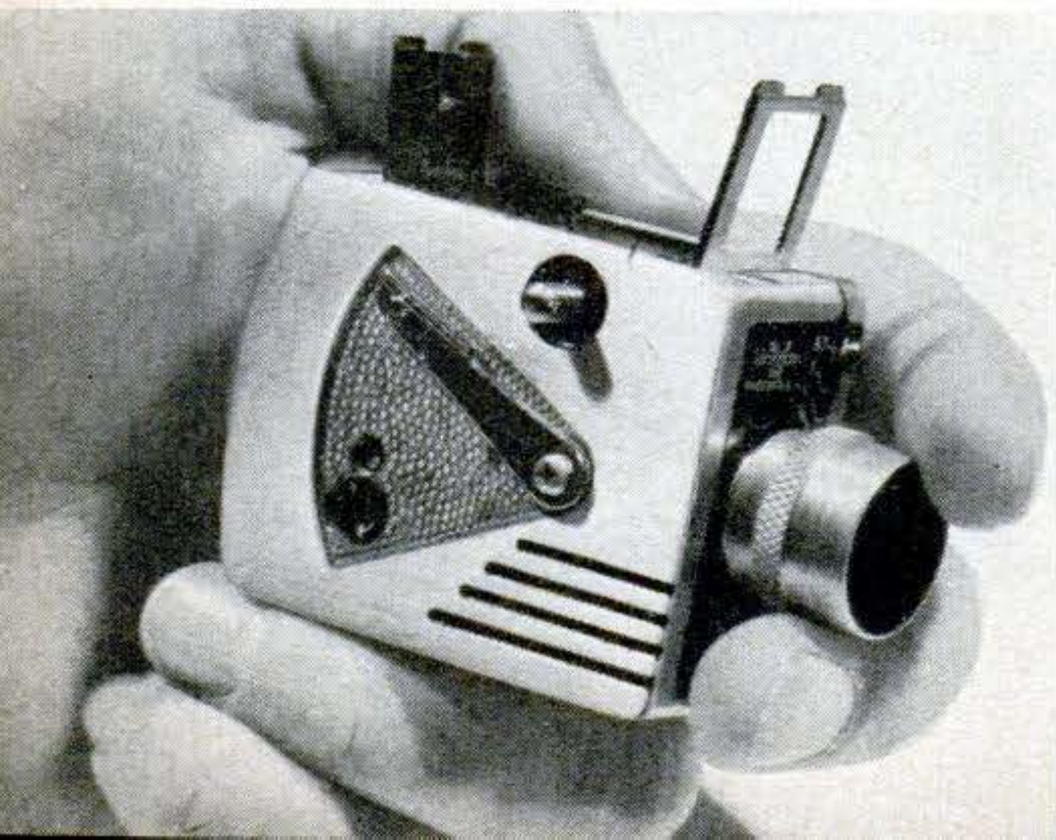
Want to have a camera always with you? These babies will ride in a watch pocket, shoot in a split second.

SO YOU want to be a secret agent and photograph spies as they pass the stolen papers? Your equipment is all ready for you. There are cameras no bigger than a pack of cigarettes. There are others the size of matchboxes. There are watch-sized cameras that strap on your wrist.

If you are going to be a top-drawer secret agent, pursued by beautiful adventuresses, you can get a precision-built foreign job that will set you back some $150. If you are more of a bottom-drawer type you can have a not-quite-so-precision-built foreign job for less than $10.

Even if your FBI appointment doesn't come through this month, you can still have a lot of fun with one of these subminiatures. But this special breed of camera needs special handling. Don't forget:

• Some of the negatives are so small that 20 to 25 of them would fit into a 35-mm. Leica frame. So don't expect the enlarge-



LIKE A TINY MOVIE CAMERA with its thumb-lever film transport, the Universal Minute-16 is one of few U.S. subminiatures. Same lever recocks the shutter. The f/6.3 lens has a fixed focus covering from 3′ to infinity. The shutter is set at 1/50 of a second. The camera uses 16-mm. film, which comes in 14-exposure, daylight-loading magazines. Processing is done by the manufacturer, and you get your camera—which lists for about $10—for nothing if you send in 30 films to be processed. Color film is available. A special flash unit is made for the camera.

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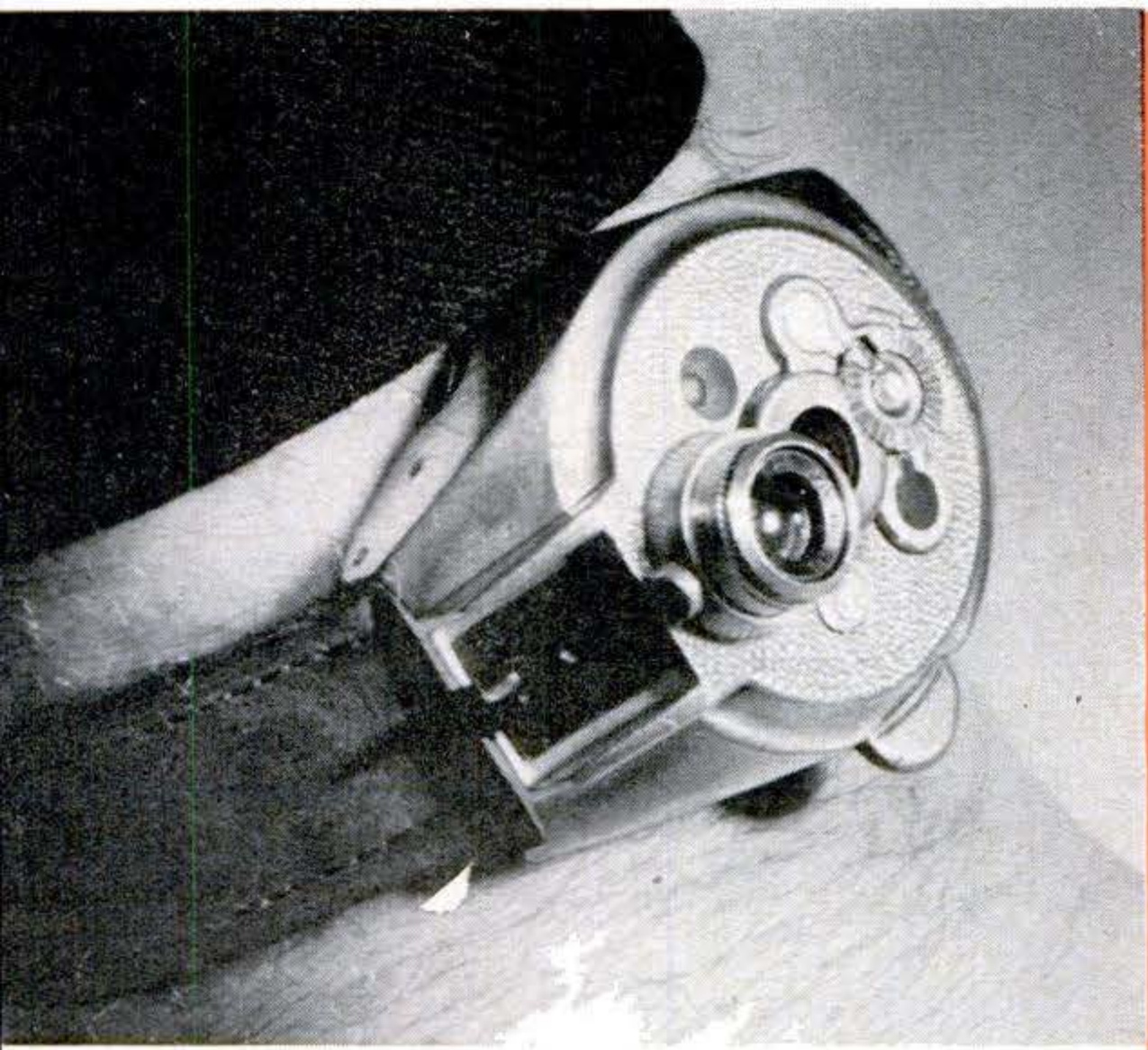
You Can Hide in a Hand



WRISTWATCH CAMERA is the Steineck A-B-C, which is aimed by looking down from above into a concave metal mirror, at left in photo. With a fixed focus, the 1½-ounce camera has only two lens openings: f/2.5 for cloudy weather, f/6.5 for sunny days. The shutter is set at 1/125 of a second. Price: $150.

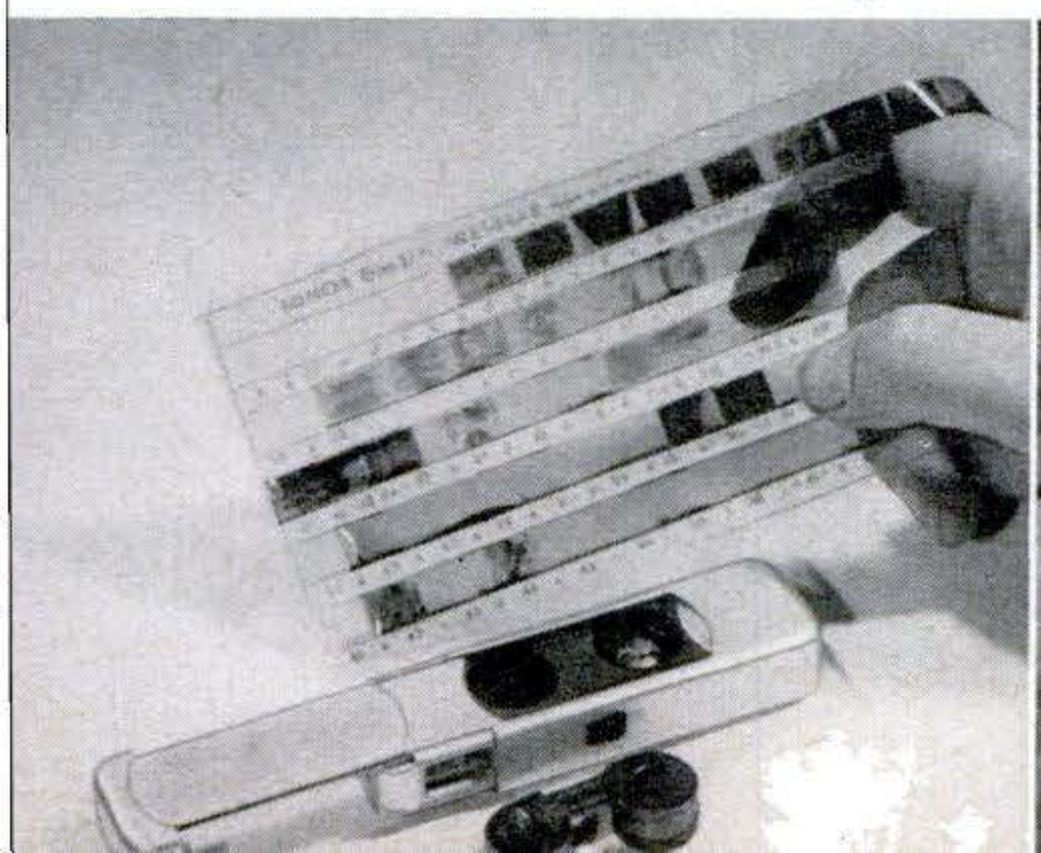
FILM for Steineck is tiny circle that fits into a thin cassette, shown removed above, which screws into back of camera. As each picture is taken, the cassette is automatically rotated to move unexposed film behind the lens. When film is finished, entire cassette is sent to the camera's distributor for processing.

EXTRA-LIGHT MINOX weighs only 2½ ounces. A fine precision camera, it has an f/3.5 fixed-focus lens with a fixed opening. Shutter speeds vary from ½ to 1/1,000 of a second. Negatives, shown in strips in photo below left, are 8 by 11 mm. Camera is open to show how the daylight-loading magazine, which holds 50 frames, fits into the side. Made in Germany, Minox sells for $129.50.

Center photo below shows how binoculars can serve as Minox telephoto lens. Camera replaces the right eyepiece; the user then uses the left side as a coupled range finder.

The Minox tripod is shown in use as a monopod. The single leg has two more legs inside it. The tripod comes with a tilting head.

Minox daylight-loading tank for developing film is shown below at right. Core, removed from tank for clarity, has spiral channel into which film fits. Still in its magazine, film is clipped to a rotating ring, held by left hand in photo. The ring is then fitted onto the core, which is inserted into the tank. Turning knob on top then screws core down into tank, at the same time pulling the film out of the magazine into the channels.



ments you get with a standard miniature.

• You must learn to freeze when taking the picture. A subminiature is practically weightless. It is easy to push the whole camera instead of just the shutter release. The result is a fuzzy picture.

• Since most of these little cameras are swallowed up in a man-sized fist, it is awfully easy to block the lens. You must practice holding the camera so that all your fingers are accounted for.

• Many very small cameras take odd sizes of very small film, so you aren't going to be able to take your negs down to the corner drugstore. Most of the camera distributors provide a mail-order lab service. In some cases, you can buy special developing tanks and do the job yourself.

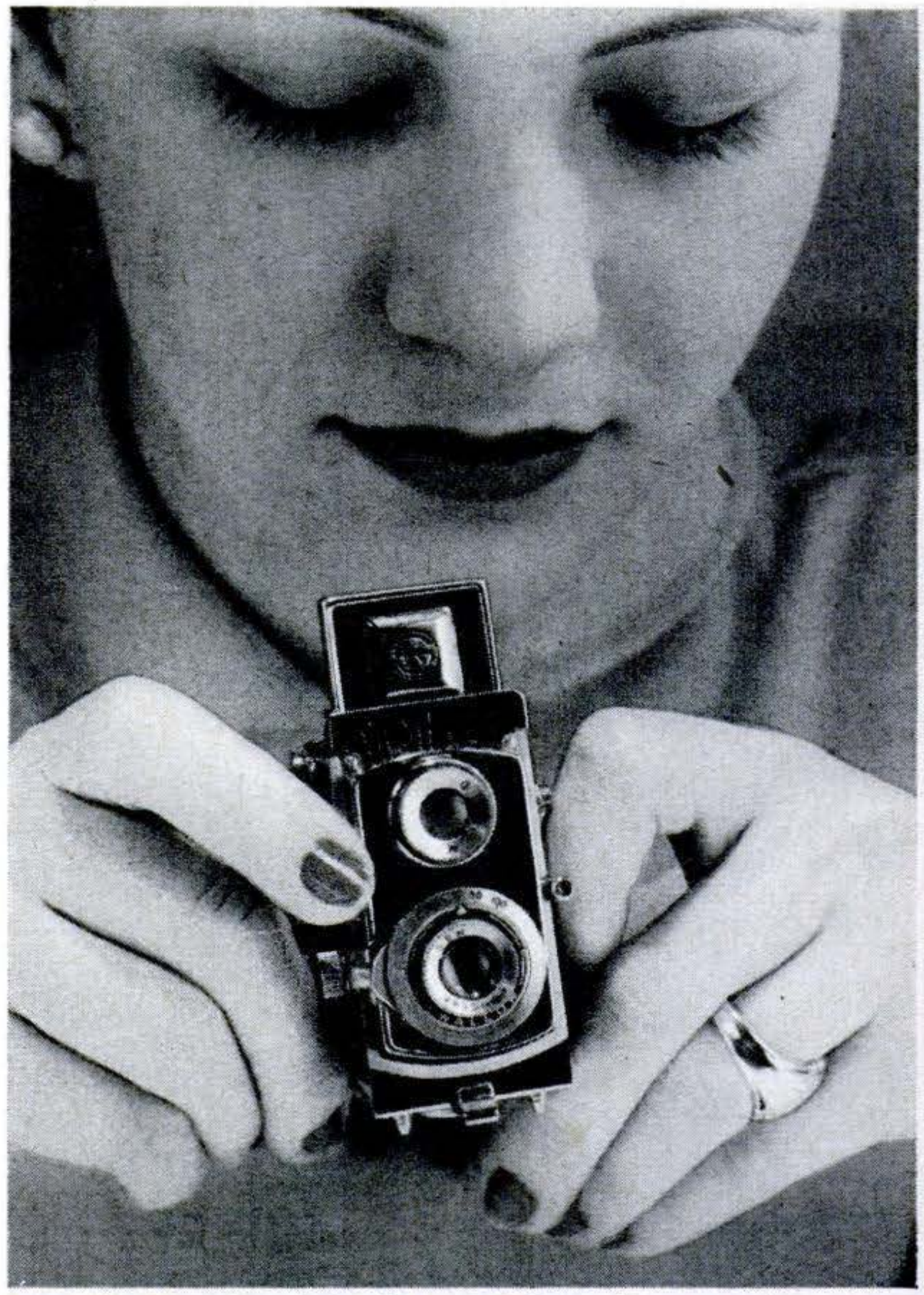
Obviously, these little cameras are not for everybody. The man who wants a single good camera for all-around work had better look elsewhere. But the subminiature has a lot to offer the man who likes to have a camera always in his pocket, or the fellow who just likes to wander around quietly recording the public antics of the human race.

And of course if your FBI appointment does come through—why, you're all ready to go to work on those spies!—*Hartley E. Howe.*

Further information about the cameras pictured on these four pages can be obtained from: MINUTE-16—Universal Camera Co., 28 W. 23rd St., NYC; STEINECK A-B-C, PETAL, RUBINA and RUBIX—Ercona Camera Corp., 527 Fifth Ave., NYC 17; MINOX—Minox, Inc., 140 E. 30th St., NYC 16; STEKY III—Wilmot Sales Co., 151 W. 28th St., NYC; GEMFLEX—Schmidt & Co., 136 Liberty St., NYC; MINICORD—King Photo Import Co., 1133 Broadway, NYC; MAMIYA—Mamiya Camera Co. of America, 82 Wall St., NYC.

SO SMALL it is lost in your eye, the Petal is the diameter of an overcoat button. It takes six pictures on a tiny ring of film. Shutter speed and lens opening are fixed. Enlargements are included in price of film. Made in Japan, Petal sells for less than $10.

A TELEPHOTO LENS, shown mounted above, comes as an accessory to the Steky III. This 16-mm. job, made in Japan, lists for about $22. The standard f/3.5 lens has a fixed focus, can be closed down to f/16. There are three shutter speeds and bulb. Film, in 24-frame cartridges, is processed by the distributor. Accessories include a flash gun.



SIZE ALONE is what distinguishes the tiny Gemflex from the familiar twin-lens reflex cameras at first glance. Actually, the top lens of the Japanese-made camera is a viewer; the f/3.5 taking lens has a fixed focus. There are three shutter speeds and bulb. Made of die-cast duralumin, the camera uses 14-mm. film. It lists for about $20 with six films.

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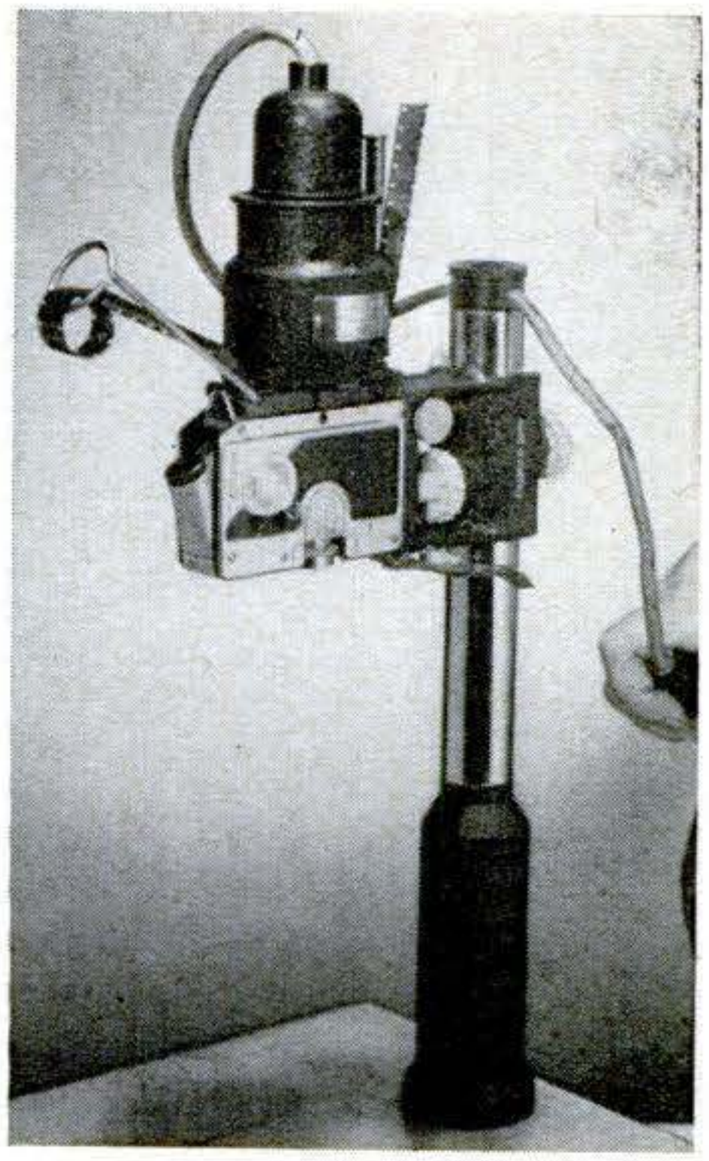
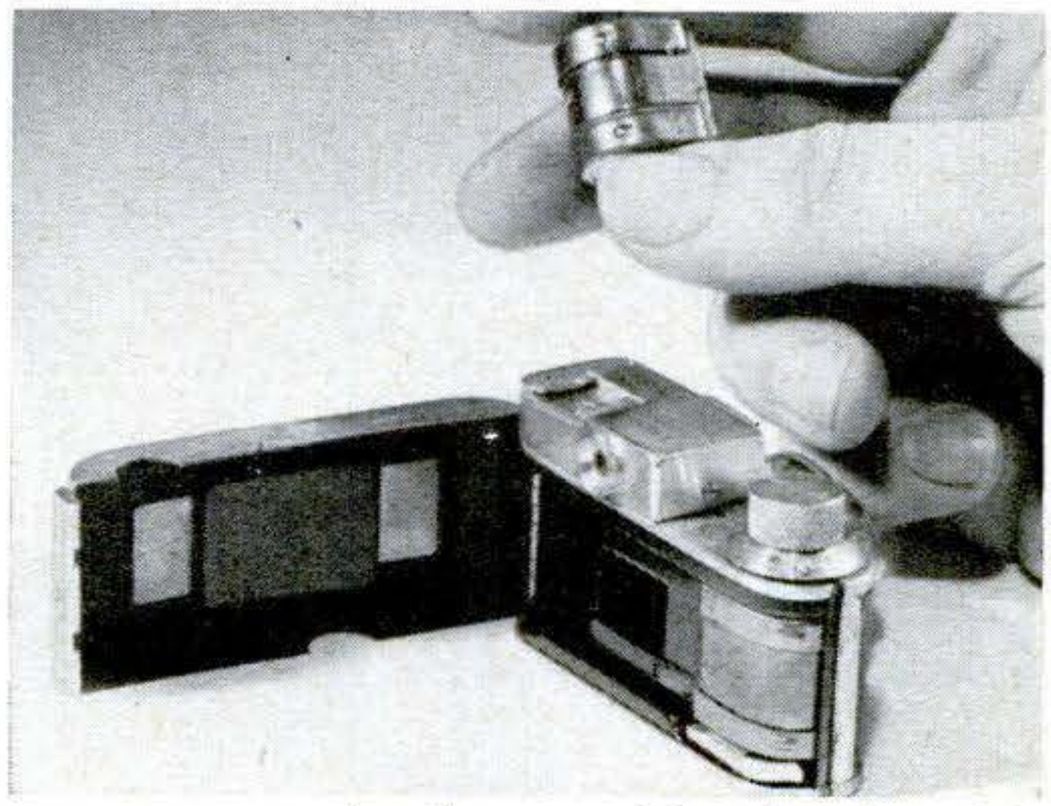
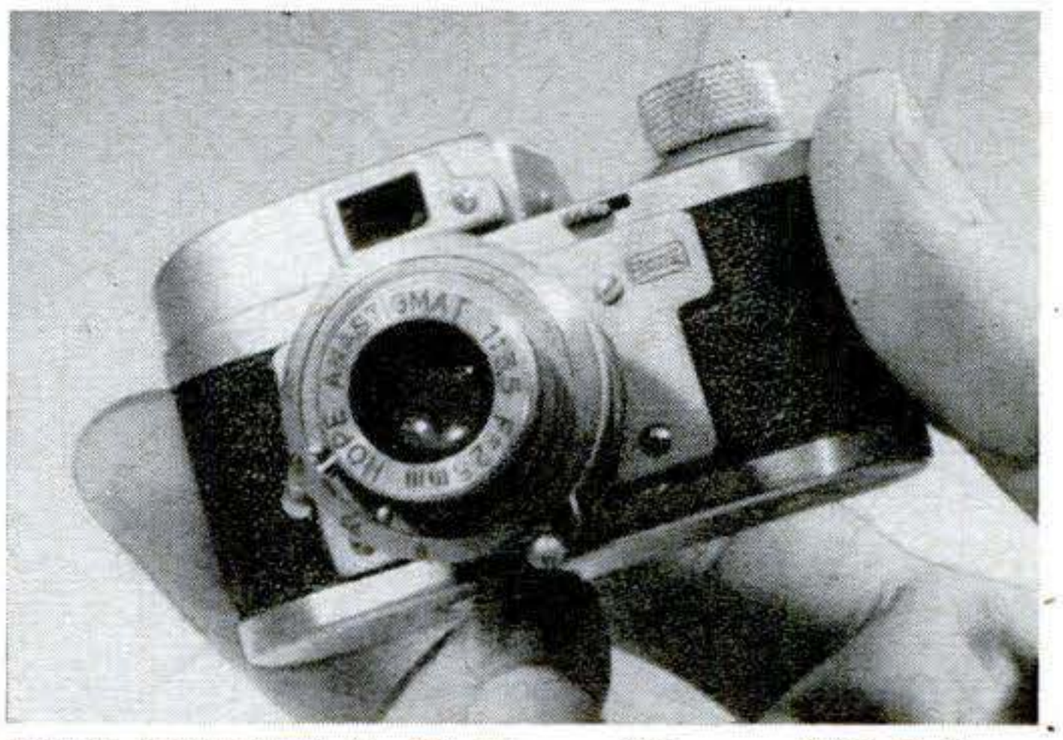
A TRUE REFLEX camera, the Minicord has twin coupled lenses with an f/2 taking lens. No bigger than a pack of king-sized cigarettes, the Austrian-made camera uses 16-mm. film, lists for $97.50. The all-metal, focal-plane shutter has speeds from 1/10 to 1/400 of a second. The camera is especially suited to quick-sequence pictures: pulling back the lever beside the lens transports the film and resets the shutter. As shown at right, the Minicord's special enlarger uses the camera itself to project the image. A negative holder is substituted for the film holder at the back of the camera. The whole enlarger packs into the wooden box that serves as a base.



THE FLASH ATTACHMENT towers over the match-box-size Mamiya Super-16. Made in Japan, the camera has an f/3.5 lens that stops down to f/11. The shutter speeds range from ½ to 1/200 of a second. Pushing a small knob in the front of the camera slides a built-in filter across the lens. Pulling out viewing frame unlocks shutter. Price: $39.95.



TINY RUBINA closely resembles familiar 35-mm. cameras in design. Above, the back is open, revealing the 16-mm. film magazine. The f/3.5 lens stops down to f/16, focuses from 2′ to infinity. There are three shutter speeds and bulb. It sells for about $20.



EVEN SMALLER is Rubix, with an f/3.5 lens and three shutter speeds. Made in Japan, it sells for about $15. Like Rubina, it uses 16-mm. film, has a 14- by 12-mm. negative. END

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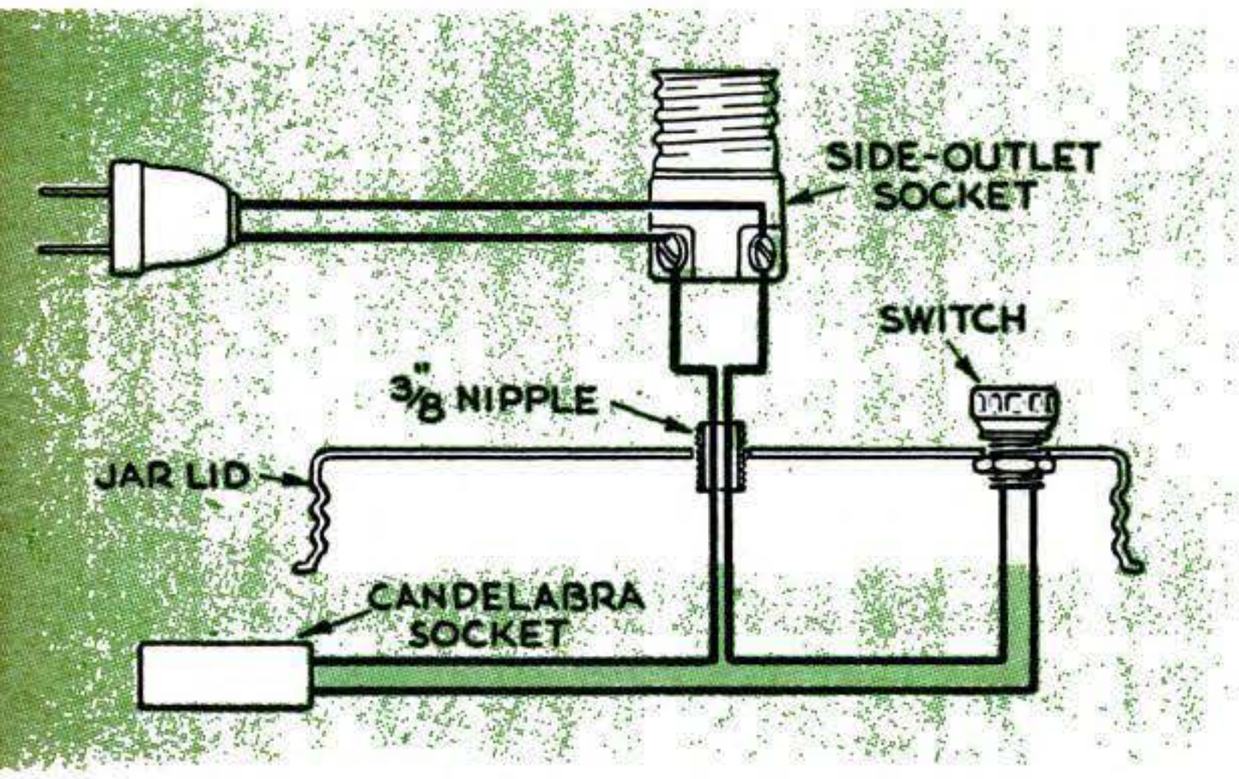
Table Lamp Is Fish Tank, Too

A small bulb under the lid of a pickle jar will put your prize fish in the spotlight.



By William F. Morton

THE decorations inside this table lamp are always changing—they're alive. The base, a gallon pickle jar, serves as a fish tank and is illuminated by a 7½-watt bulb hidden under the lid. Above the lid is a conventional lamp.

A jar can usually be had for the asking from a restaurant or grocery store. If you must settle for the narrow-mouth kind, there won't be room to mount a candelabra socket under the lid. In this case, screw a regular lamp socket on the bottom end of the pipe nipple that holds the upper lamp and use a 7½-watt standard-base bulb.

To hide the tank light, the upper part of the jar is painted, first with a coat of white enamel to reflect the light inside, then with a coat of black enamel or other color as desired.

The lower lamp is controlled by a separate rotary switch, wired as shown at left. Tape all connections, and fill the jar no higher than the paint line so water won't reach the electrical parts. Varicolored marbles decorate the bottom of the tank.

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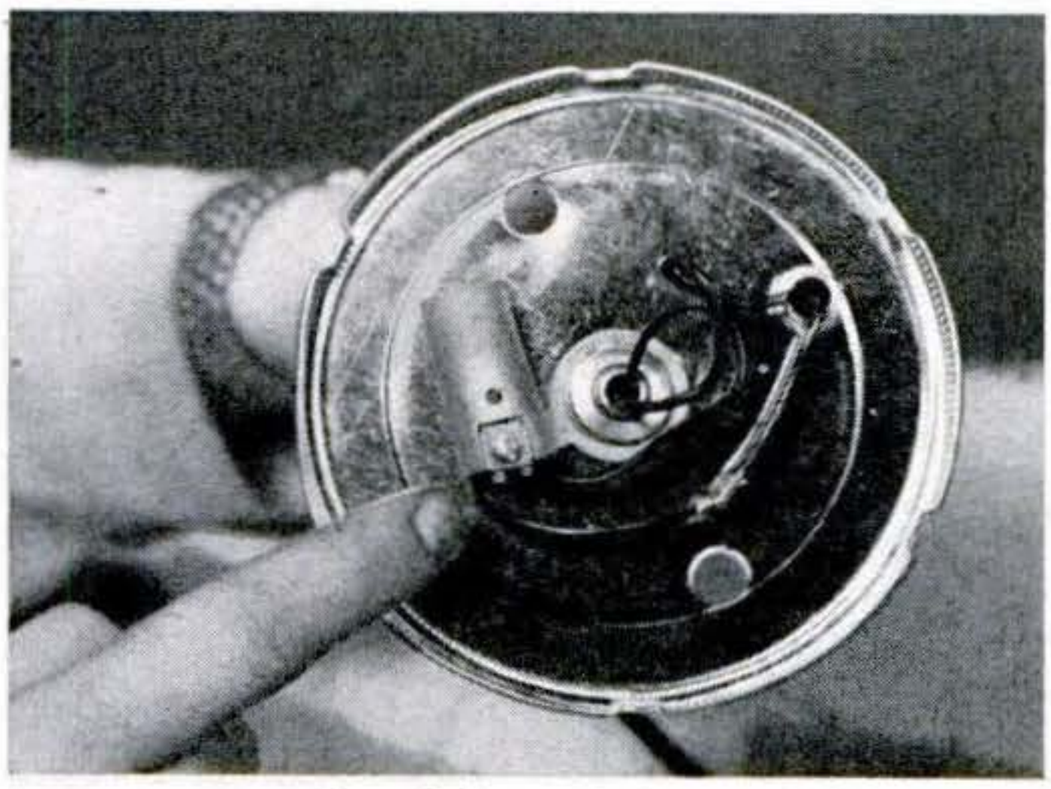
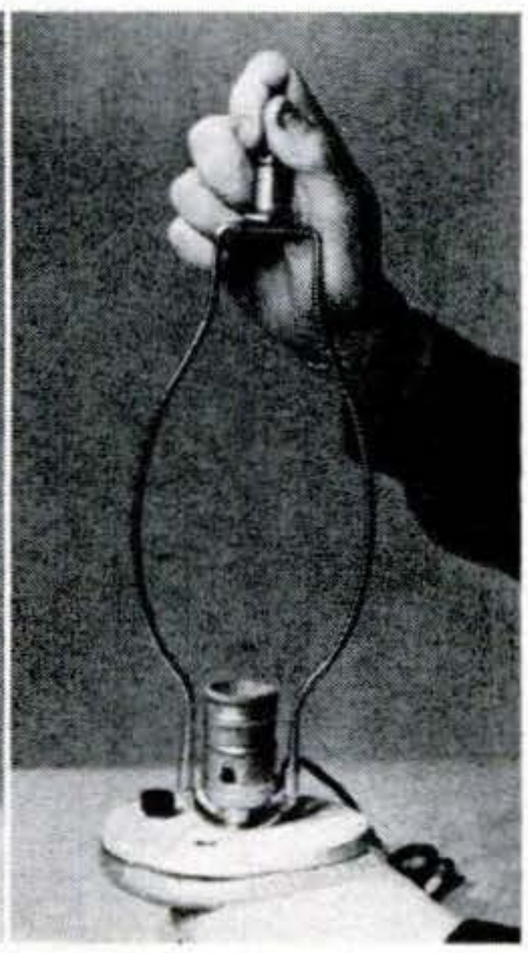
MASKING TAPE is first wrapped around jar about 4″ below top to make guide line for painting. Simple figures, cut from same tape, can be pasted around jar above line to form silhouettes. When paint is dry, peel tape off carefully.



LOWER LIGHT for fish tank is small 7½-watt, 110-volt candelabra socket, held on underside of jar lid by nut on pipe nipple. Rotary switch is mounted through ⅜″ hole at right. Other holes vent heat, permit feeding fish.

ON NARROW-NECK JARS, tank light can be standard socket instead of candelabra. Screw it upside down onto lower end of pipe nipple in place of nut.



UPPER LIGHT is standard side-outlet socket, held on top of lid by ½″ length of ⅜″ pipe nipple and nut. Omit harp if shade is the type that clips to the bulb.

Angler Carves Model Fish

BALTIMORE businessman R. Russell Swigert likes fishing so much that he has turned it into a hobby as well as a sport. The finely detailed specimen below is one of 60 mahogany replicas he has made of his catches. He works from photos, and scales all models down to a length of 8″. To capture the fresh-from-the-water appearance of live fish, he coats a finished carving with aluminum paint, then colors it with transparent photo-tinting oil paints.

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If you're itching to join the crowd afloat this year, here's how you can in

A Boat That Anyone Can Build

You can power it with oars or outboard. Neither time nor cost should stop you. About $12 and 16 hours will complete the job.

By Stanley Stearns

IF YOU are a professional boatbuilder, let your wife cut out this article before you read any more. And don't blow up if she begins telling you what a snap job *you* have. For it's true that anyone can build this boat.

If you are just plain *anyone*, beg a few dollars (about 12), borrow some tools (a hammer, chisel, plane, saw and a heavy drift), buy your materials and steal some time (around 16 hours if you don't waste any of it). You'll wind up with a strong boat that will perform well with any outboard from 1½ to 22 horsepower and will even respond to rowing.

The lack of a framework is the secret of the simple construction. The sides fair naturally around the single mold stick inserted between the stem and the stern. You can bang the job together with about four pounds of eight-penny nails—use galvanized, bronze or copper nails if you're around salt water. In fresh water, plain nails will last 10 to 15 years, but salt water eats them up fast. If you plan to power the boat with a husky outboard, toss in a few screws here and there, where nails can't be clinched.

Check the list of materials and take a look at Figure 1 to see how the parts are chopped out, then chop away.

A rabbet plane is ideal for cutting the scarfs and rabbets (notches) in both the stem and side planks, but it can be done with an ordinary plane, if you clean the corners with a chisel. Do the transom and keel first, if you wish, for morale purposes—you'll need to have something accomplished to forestall snide remarks from your family and neighbors. The stem should present no difficulties. Just shape it and leave the ends until later. The less said about the side planks the better, except to note that the shortest one will determine the length of the boat. Once you know that, the mold stick can be made the proper length. Try to get the front-end angle of the side boards the same on each side of the boat, if you want it to be absolutely straight. Be sure they overlap in such a way that there is a shelf inside the boat on which to rest the seats.

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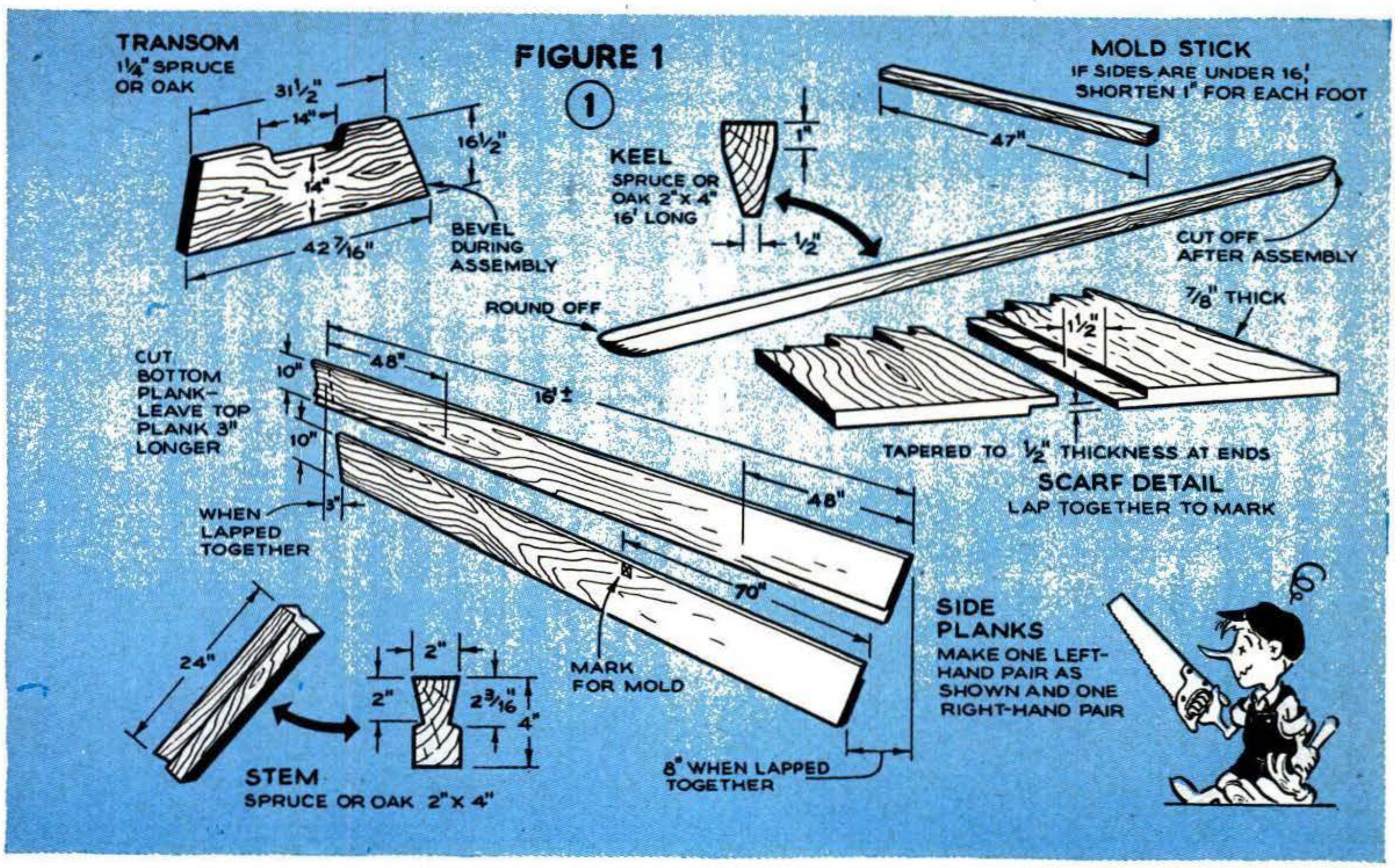

Now for step 2 in Figure 2, which is easy. At step 3, you'll see a little diagram showing how the stem should be lined up at 90°, after you have one set of side boards nailed firmly, and the other side tacked loosely enough to "wee-waw" into alignment. Don't take this too seriously. It doesn't have to be done. Contrary to learned opinion, a crooked boat can go very well with an outboard motor.

Step 4 is where your boat—yours, all yours!—begins to take shape. Pull in the bottom boards, somehow. As soon as they are lassoed and hog-tied in, try the stern in place (just the bottom piece, if yours is in two pieces), and bevel the edges to fit the side boards. Since the bottom edge of the stern piece isn't beveled yet, allow it to drop down as in the detail drawing, slap on white lead and twine, and tack up the side planks.

You're feeling pretty cocky now? Here's a little detail to bring you down to earth. See that innocent-looking string going straight down the center of the boat in step 4? Well, if you're still set on having a straight boat, just push and pull things in relation to the transom until you get the string to fall naturally over the center mark on the mold stick. However, if this aligning looks tough, skip it. Either way, nail the planks down tight.

Next, put your rope around the whole boat to pull in the top side boards. Fit the rest of the transom if yours is cut in two pieces. There need be nothing in the joint between the two, and they need not be nailed to each other. Smear more white lead and twine along the transom and tack

LIST OF MATERIALS

Sides, 4 pieces ⅞"-by-10" pine, 12' to 16' long.
Keel, one piece 2"-by-4" spruce, same length as sides.
Stem, 2"-by-4" spruce, 2' long.
Transom or stern, 1¼" spruce, 16½" wide by 4' long, or two pieces totaling 16½" width.
Bottom planking, about 120' of ¾"-by-6" pine or cedar.
Seats, ⅞"-by-10" pine or cedar, about 16' to make four seats.
Trim, 2 strips of spruce, ⅞" by 2", same length as sides.
Mold stick, any piece of scrap 4' long.
Thin sheet metal, 1¼" by 10" for binding sides to transom. Also squares for patching weak spots.
White lead, about 1 lb.; some twine, cotton batting or old sheet.

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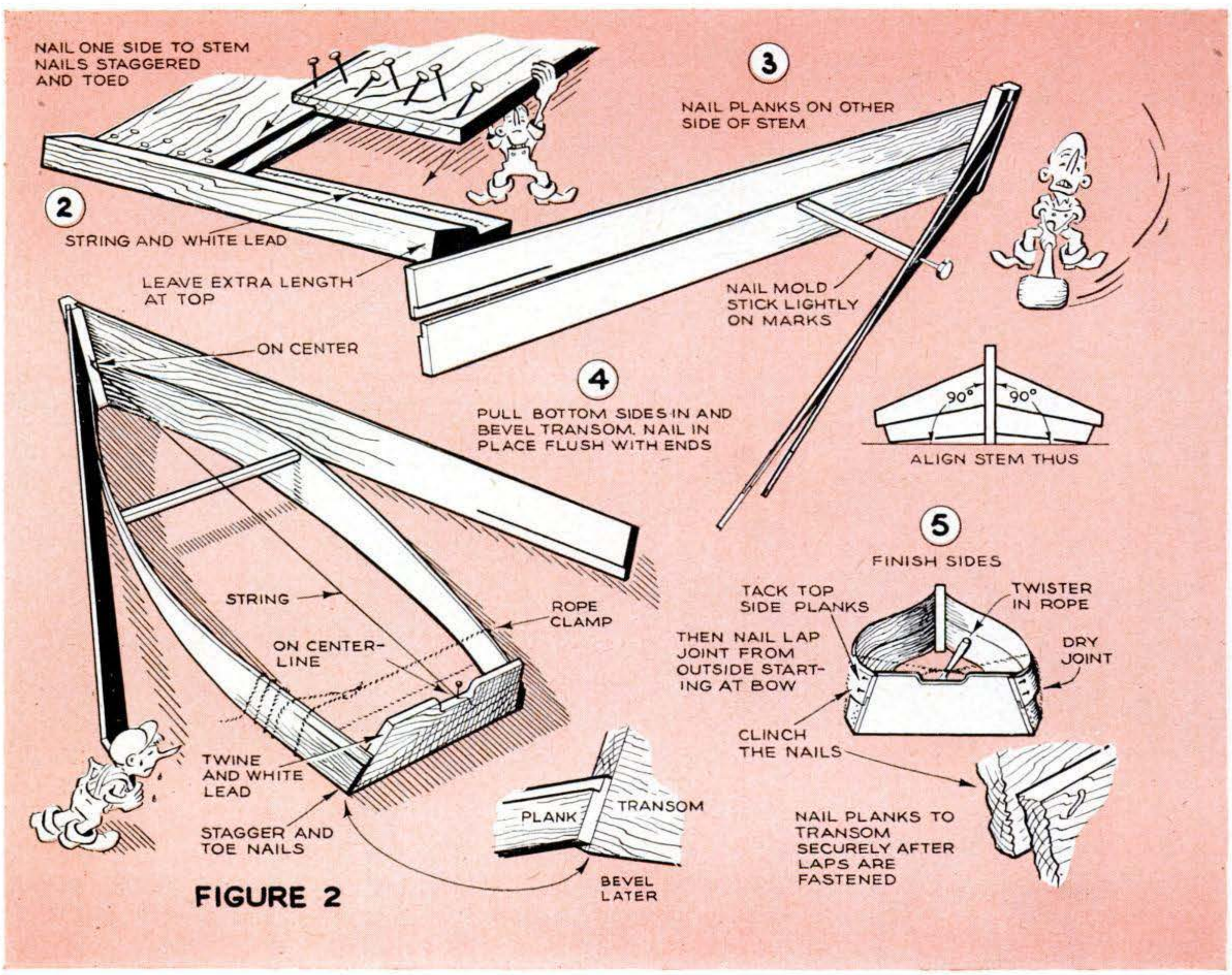

FIGURE 2

on the top planks temporarily, nailing securely after fastening the laps. To do that, nail the side boards together along their whole length through the lap-over as per step 5. To clinch nails correctly, hold a heavy drift, axhead, any piece of heavy smooth metal or a rock against the spot where the nail will appear, and drive the nail all the way in. The drift will curl the point back into the wood. When you find that method doesn't work, pound the nails through, hold the drift on their heads, and bend the tips over with your hammer. If you still have trouble, remember a few hammer marks add character to your work.

Is it beginning to look like a boat? Hah! Turn it over. Bend down, if you still can, and sight along the bottom edges of the sides. Better call them "chines"; that's what they are, and it'll show those neighbors who persist in sneering at your efforts. You will notice that the chines whoomp up in the middle. Cut them down until they look like step 6, with all the curve out of the rear three-quarters of the boat. Be very careful not to get a hollow here; a slight rise is better than that. If you get the bottom perfectly flat, the boat will run well with a motor and will "plane." You ought to try this boat sometime with a 22-horsepower motor just for the big kick you'd get out of it. A slight downward slant at the bow will lift it rakishly when the boat is righted. Bevel the chines, transom and base of the stem so the bottom will fit closely.

Plank the bottom. That means nail on the floor. Don't put anything in the seams

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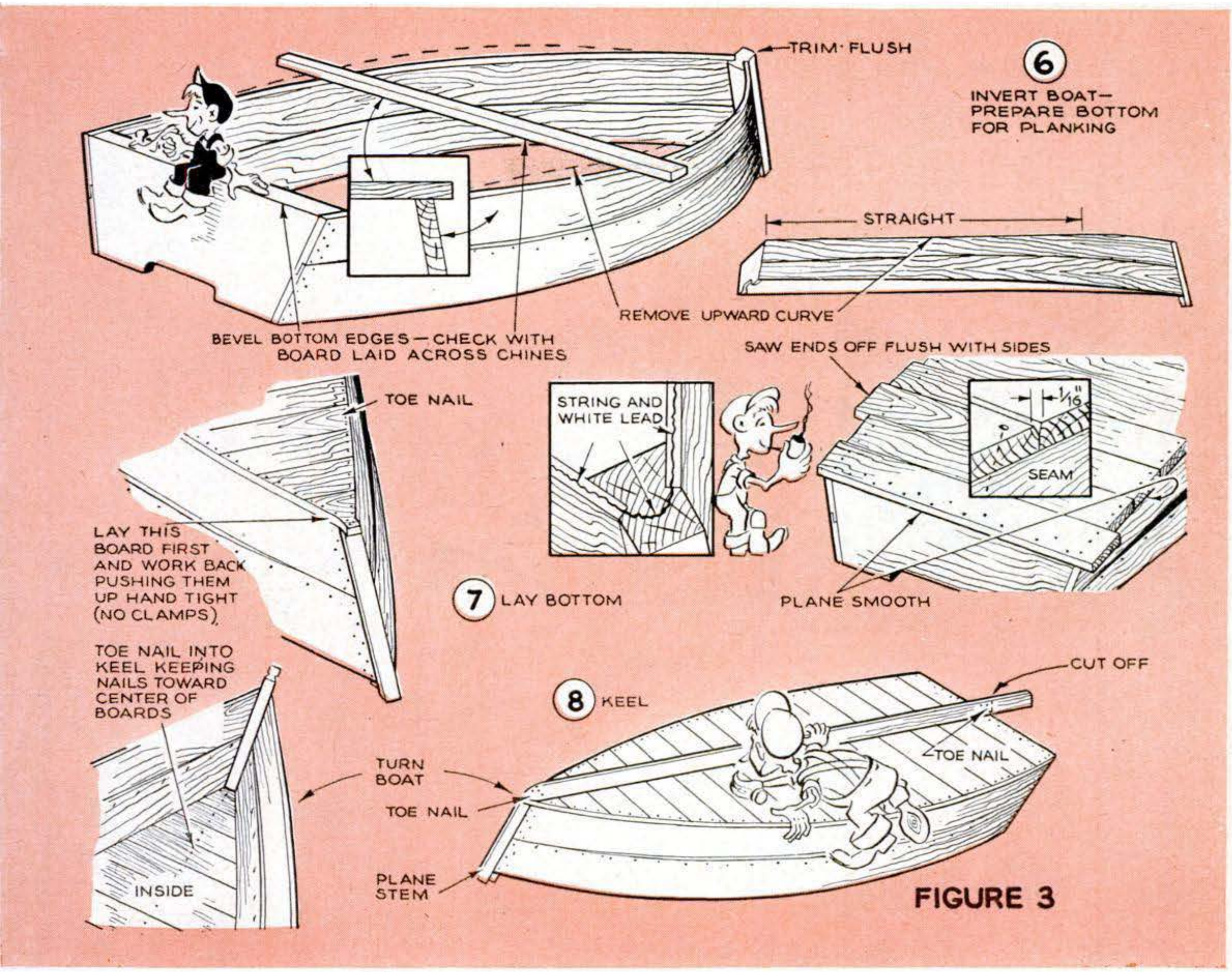

FIGURE 3

between the bottom boards, but do put string and white lead along the chines, stem and across the transom. You shouldn't let long fine cracks between the boards alarm you unduly, but you had better plane the edges to eliminate sharp humps and hollows. Knock one corner off the edges of each board with a plane so that when they are pushed together they will leave a 1/16″ space on the water side, as in detail drawing of step 7. By careful manipulation you can get crooked boards to fit against other crooked ones and won't have to do much of any planing. This is the answer for people who cannot straighten an edge with a plane, or for those who would rather smoke a pipe and look the situation over.

Haggle off all loose ends. Add the keel, nailing it securely to the stem and transom. You might use a few larger nails here. Right the boat. Don't get nervous over this. Flop it over, quickly. It won't get any more crooked now, no matter how you treat it. Peek through the cracks in the bottom to see where the keel is and nail the bottom boards to it along its whole length. This will be fun because you are nailing down and you have lots of leeway; if you haven't learned to drive a nail yet, it will be fine practice.

By this time, you must have begun to catch reluctant gleams of envy in your friends' eyes. At least, they've stopped their sly digs, haven't they? If not, now is the time to go buy a boat and make the substitution in the dark of the night. If you're sticking with the job in self-defense, try to be alone as you struggle through the next illustration, Figure 4. It's the jury-rigging—the makeshift side that you wouldn't like to have publicized any more than you enjoy hearing your wife tell how she started the car with a bobby pin, after you had exhausted the tool kit.

Stroll around the boat slowly enough so

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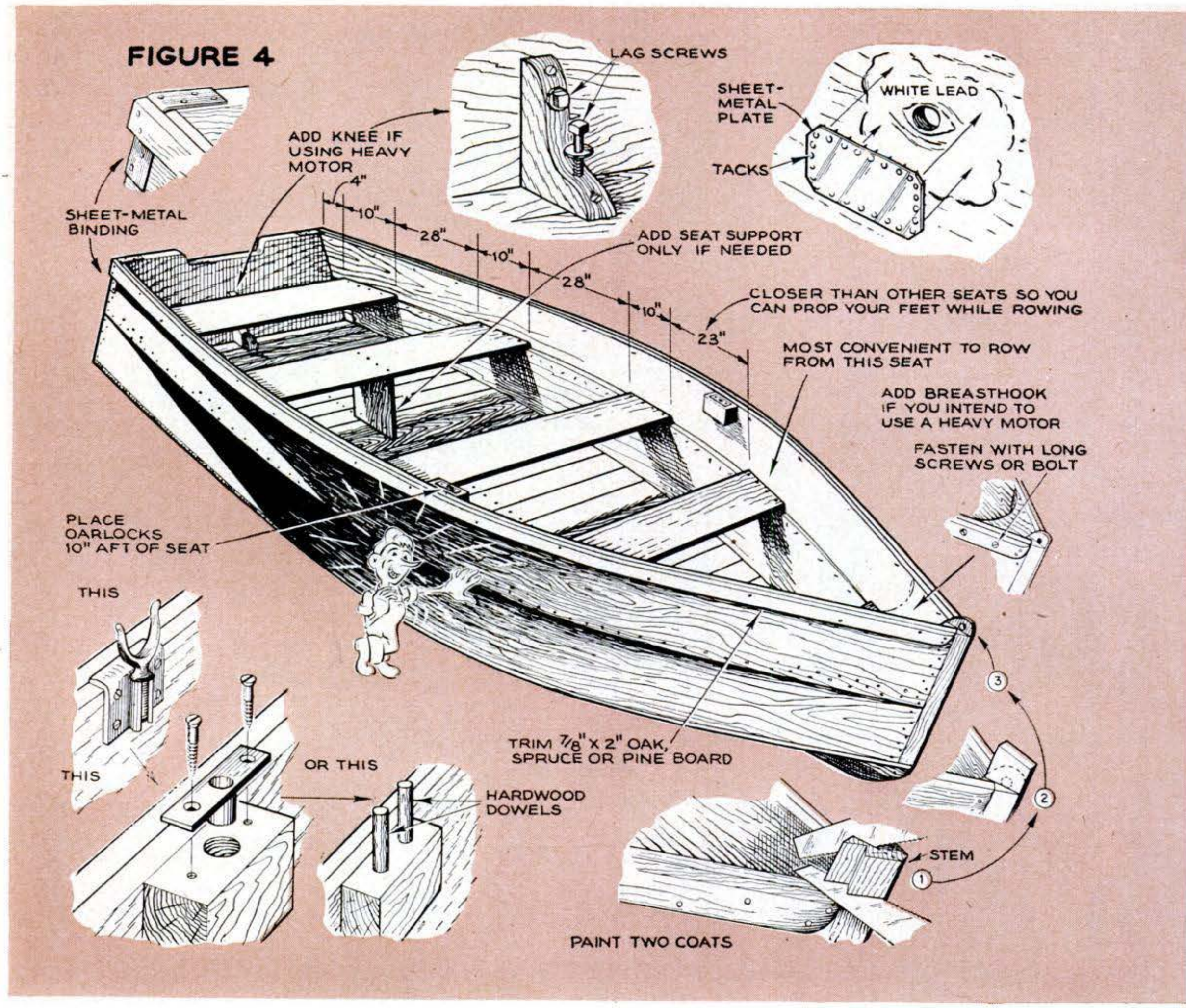

you can break off all the larger splinters. It looks better already. Now fill all the extra nail holes, before you have time to wonder how they happened to be there. Do all patching from the outside. For nail holes, drive in a small stick coated with white lead. Put a sheet-metal patch over the larger weak spots. If you get the bottom and lower two or three inches watertight, the topsides don't matter, so long as everything stays together. The sheet-metal binding at the corners of the transom goes on next, then the seats, oarlocks and trim.

Everything's fairly neat looking now except for that extra length of stem sticking up. Wha' hoppened? Well, it needs to be whittled down, and have a hole poked through it. Then paint the boat. Bright colors will cover a multitude of sins.

Now for launching; we'll slide over this quickly—it's rough. Sometime when no one is around, sneak the boat down to the water. Steel yourself. Push the boat in. Beware of the suction as it plummets to the bottom. Keep calm. Fly out of there. Act like it never happened. Return the next day and bail it out. If you find you can't make any headway against the inrushing water, wait another day. Pull the boat out, empty and relaunch. This time, mark any places that still leak. You may have to be fast at this, especially if you can't swim. Yank the boat out once more and stuff the places from the outside with more little sticks or cotton, using a hammer and screwdriver. When it dries, cover it with two coats of porch enamel—two quarts should do it.

Now you have a fine dry boat of your own and can call yourself a boatbuilder. You'll enjoy it a great deal if your friends ever give you a chance to use it yourself. If they don't, maybe you can find the lake where there are several hundred rental jobs just like it—all floating, too. END

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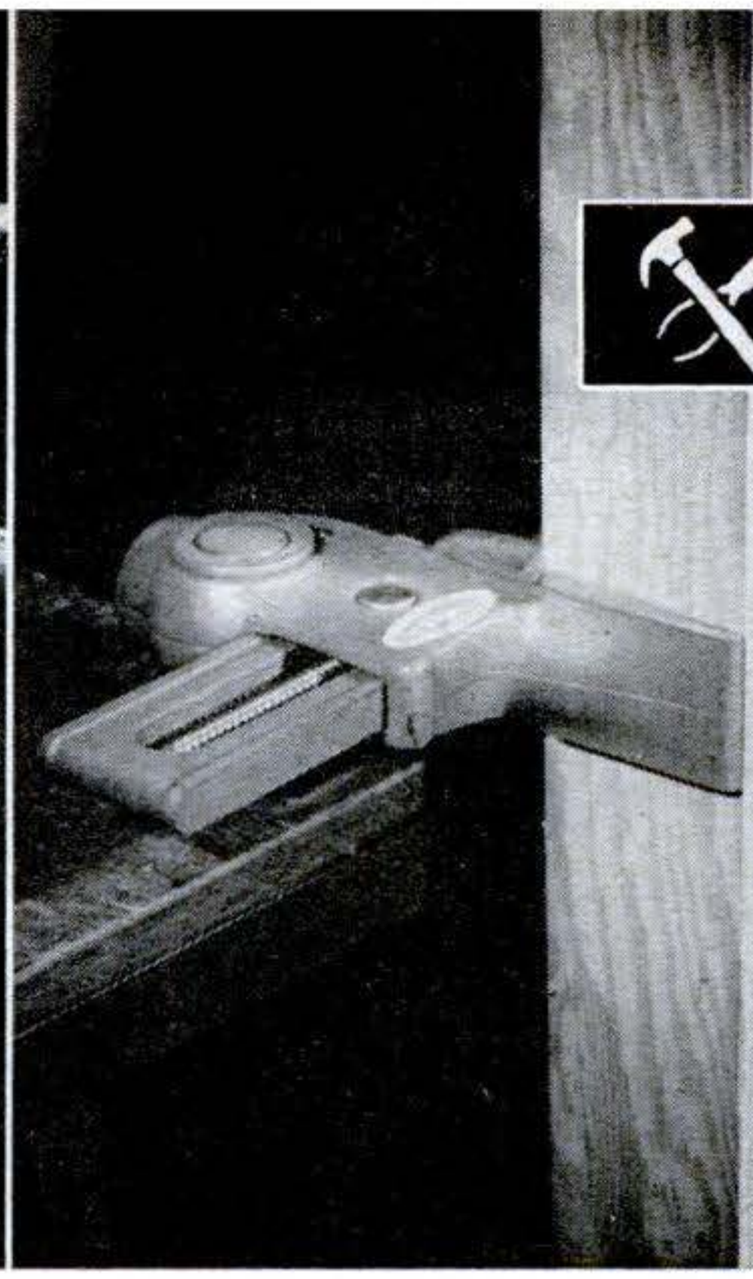
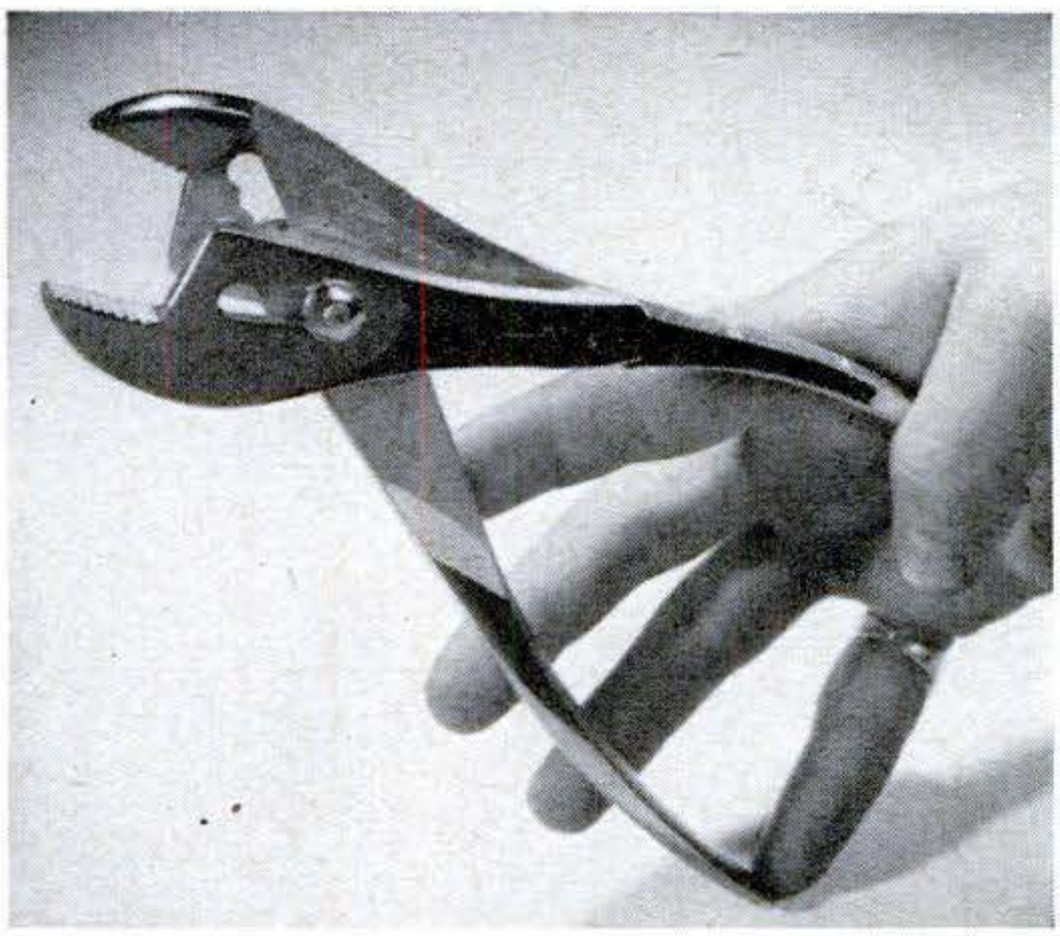
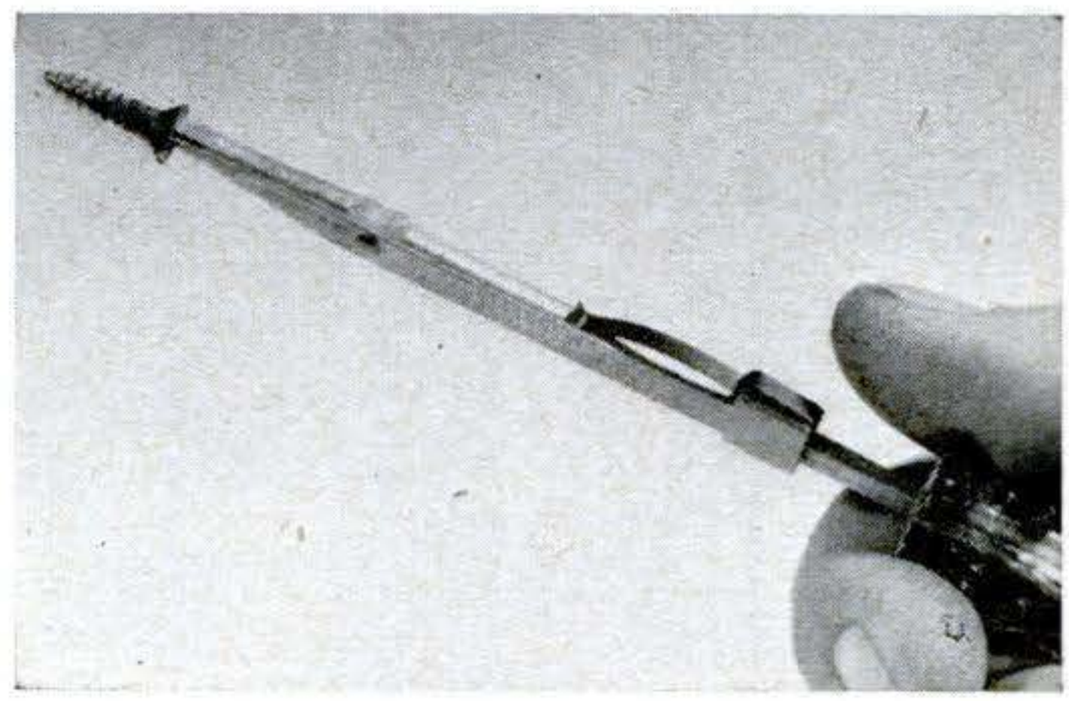


New Tools

1. Vise Works in Any Position. Slip this vise on its base post one way and it stands upright; turn it on its side and it holds large stock vertical or flat pieces horizontal. In either position, it rotates in a full circle and locks automatically as the jaws are tightened. A swivel attachment is also available that permits the vise to tilt at any angle. Vise jaws open to 5″; weight is 16 lb.

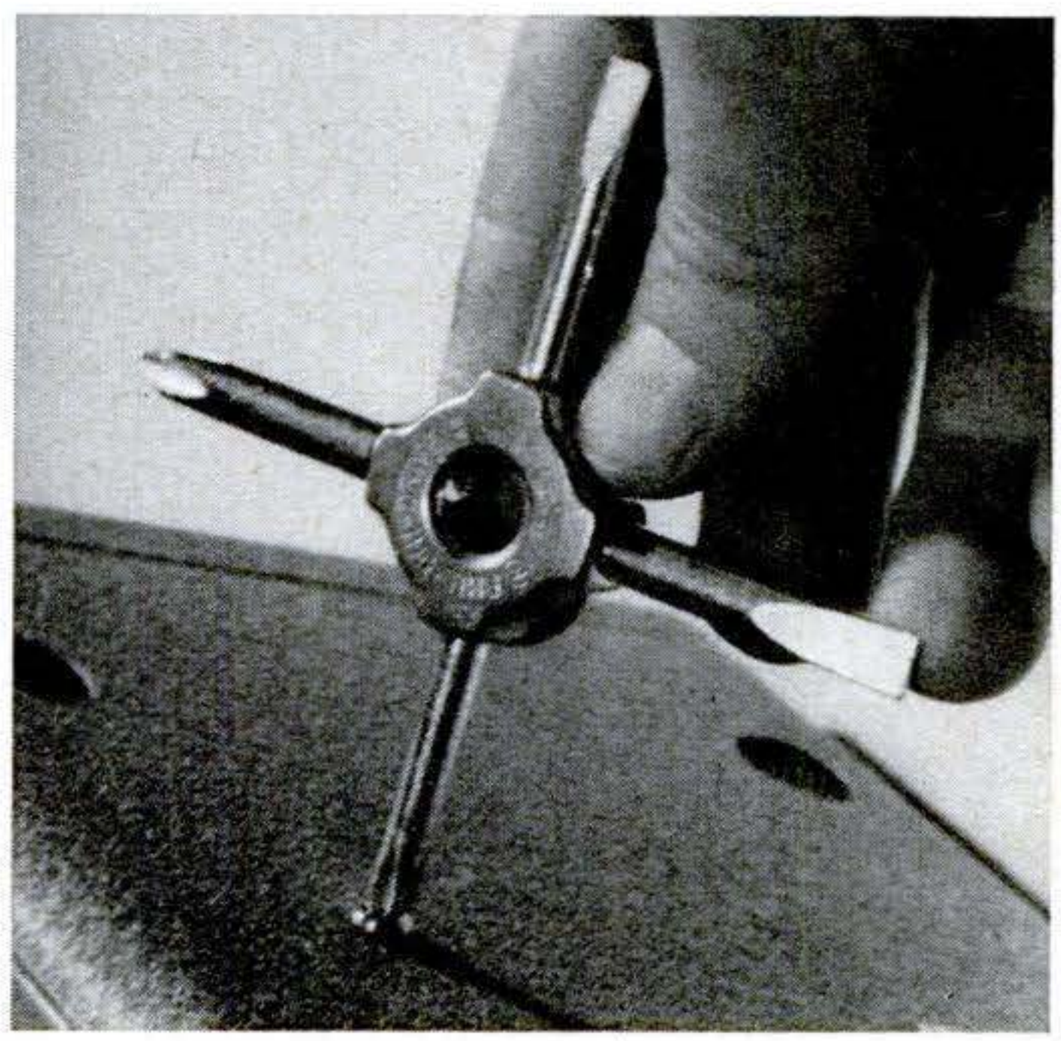


3. Pliers Multiply Grip. An extra linkage in these compound pliers multiplies the force on the jaws 10 times, enabling you to grip hard-to-hold work that would normally pry the pliers out of your hand. The jaws can be set to four positions, with a full opening of 1¼″, and have a parallel action that applies even pressure.



2. Split-Tip Blade Holds Screws. The blade of this screwdriver is split like a pair of scissors. Squeezing the tips together lines them up so they enter the screw slot; letting go then spreads the tips under spring tension, tightly gripping the screw while you start it in a hole and drive it.

4. Screwdriver Has Four Blades. Two sizes of flat blades and two of the Phillips type are combined in this four-sided screwdriver. Each pair of blades also acts as a handle for exerting extra leverage on hard-to-drive screws and for fast spinning when removing or running in screws.



Further information on the items described above can be obtained from: 1. The Columbian Vise & Mfg. Co., 9021 Bessemer St., Cleveland 4, Ohio; 2. T & T Products, 1562 DeKalb Ave., Brooklyn 22, N.Y.; 3. P & C Hand Forged Tool Co., 32nd and Llewellyn, Portland 4, Ore.; 4. Eklind Tool & Mfg. Co., 2627 North Western Ave., Chicago 47.

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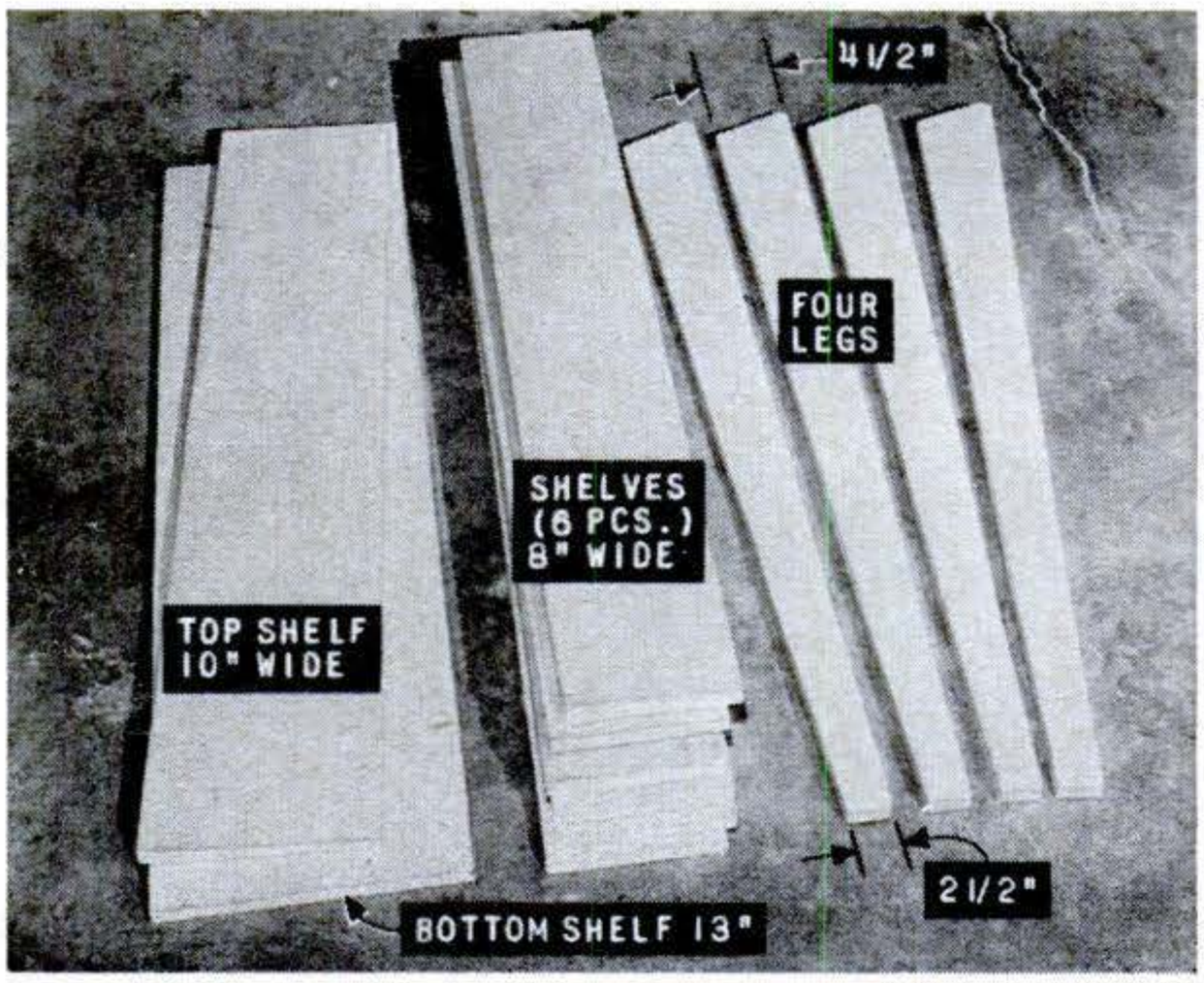
A handsome project for the living room:

Tilt-Shelf Book Rack

It holds magazines, too, at an angle that makes the titles easy to read.



ALL PARTS are of 1″ lumber, 13/16″ thick and 48″ long. Legs are tapered on the outside edges.

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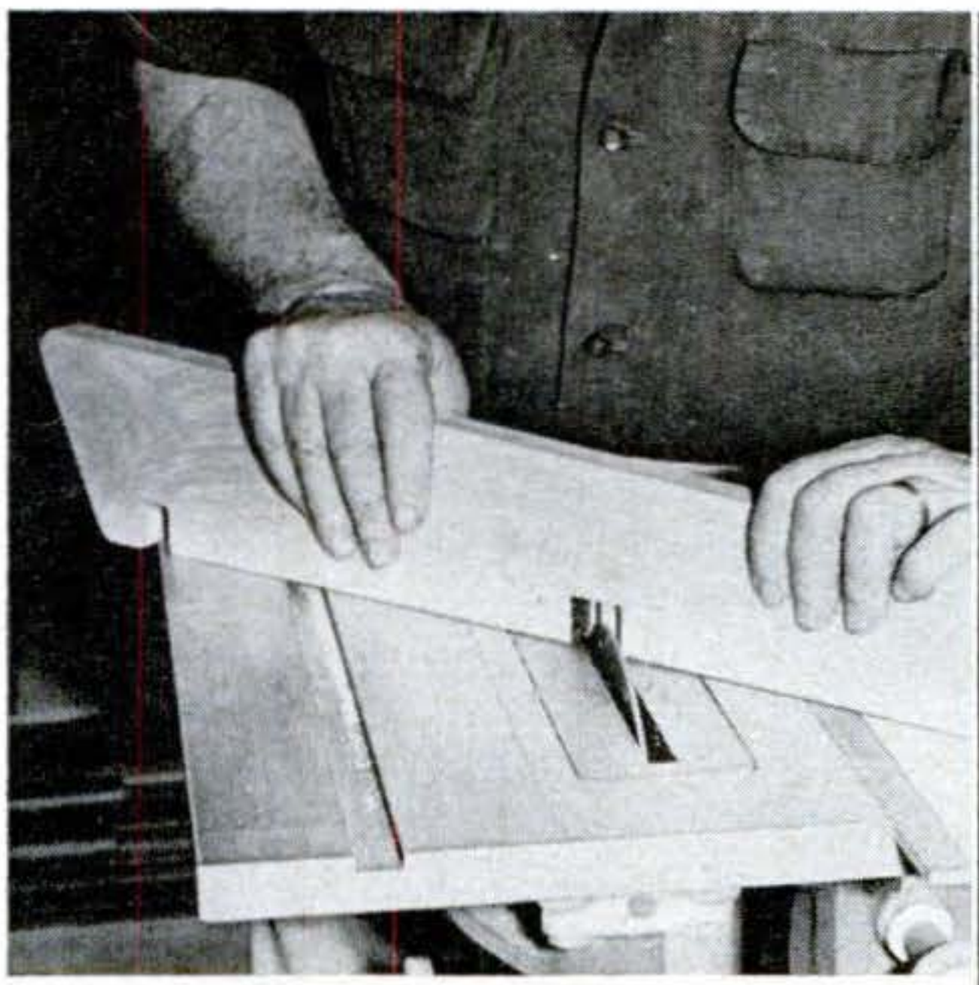
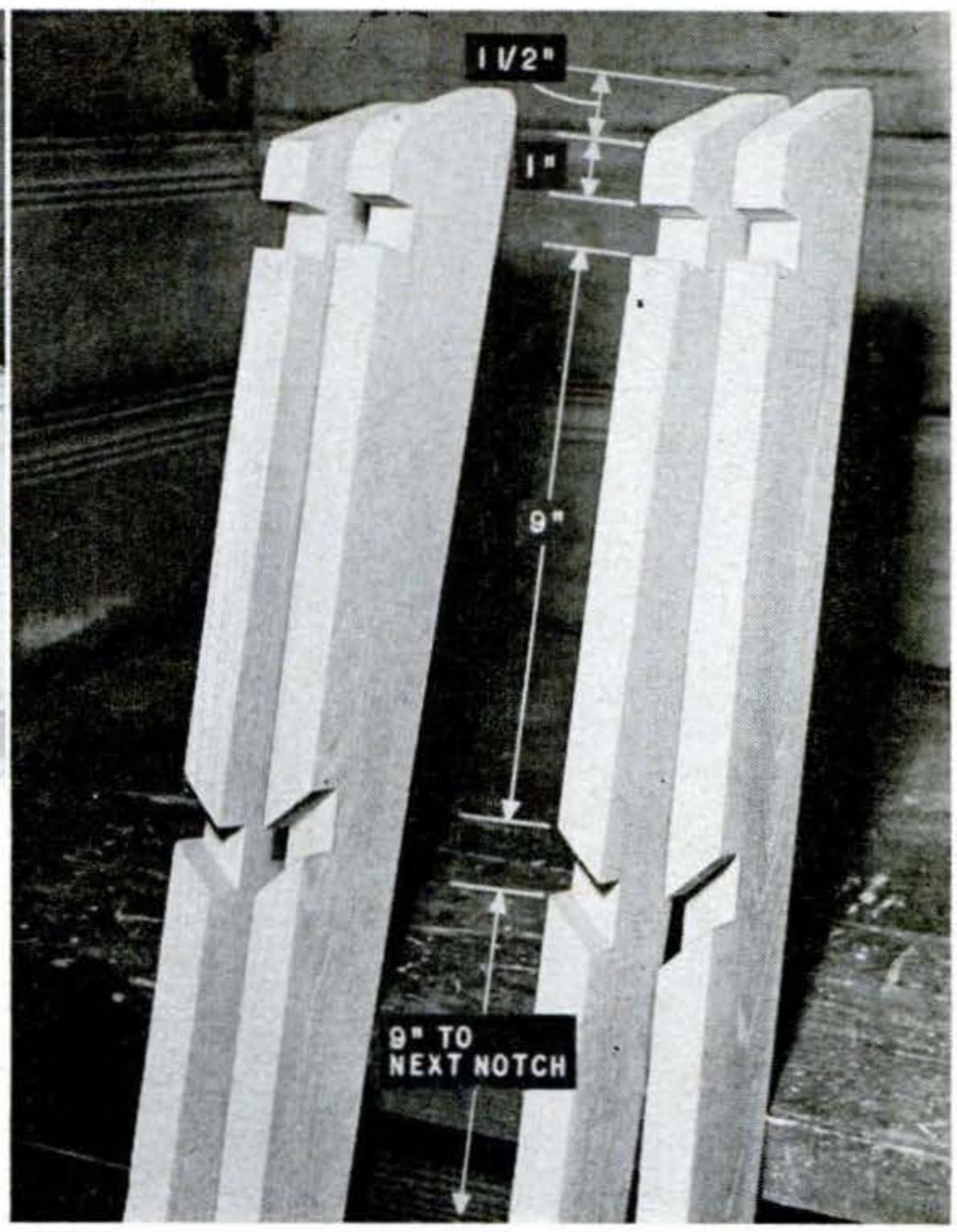
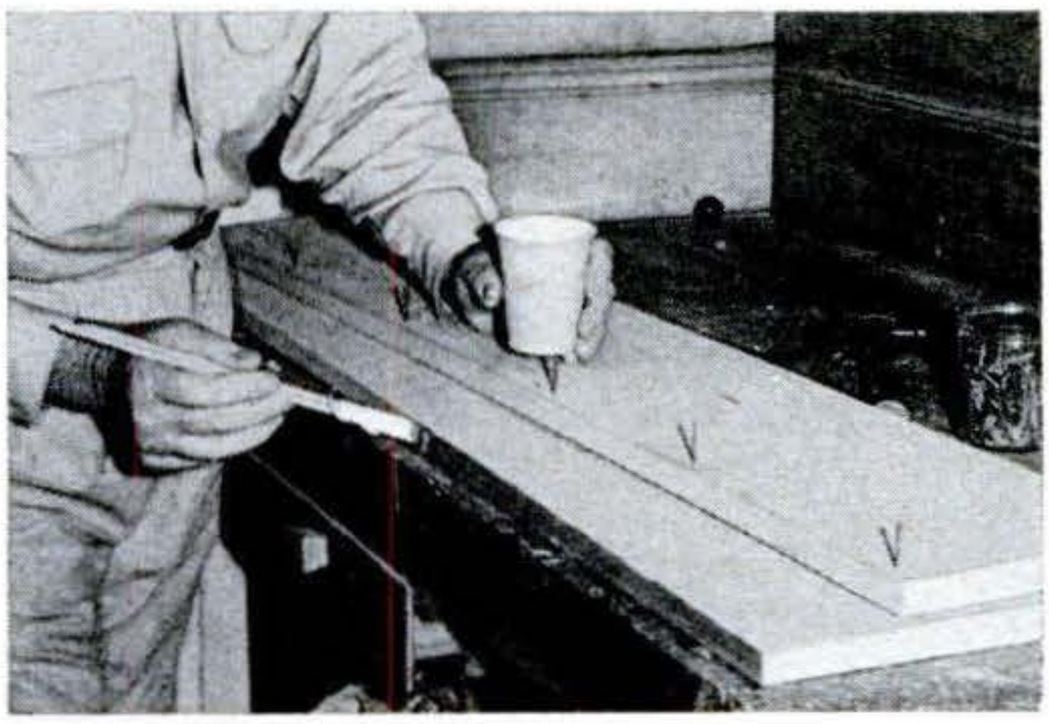


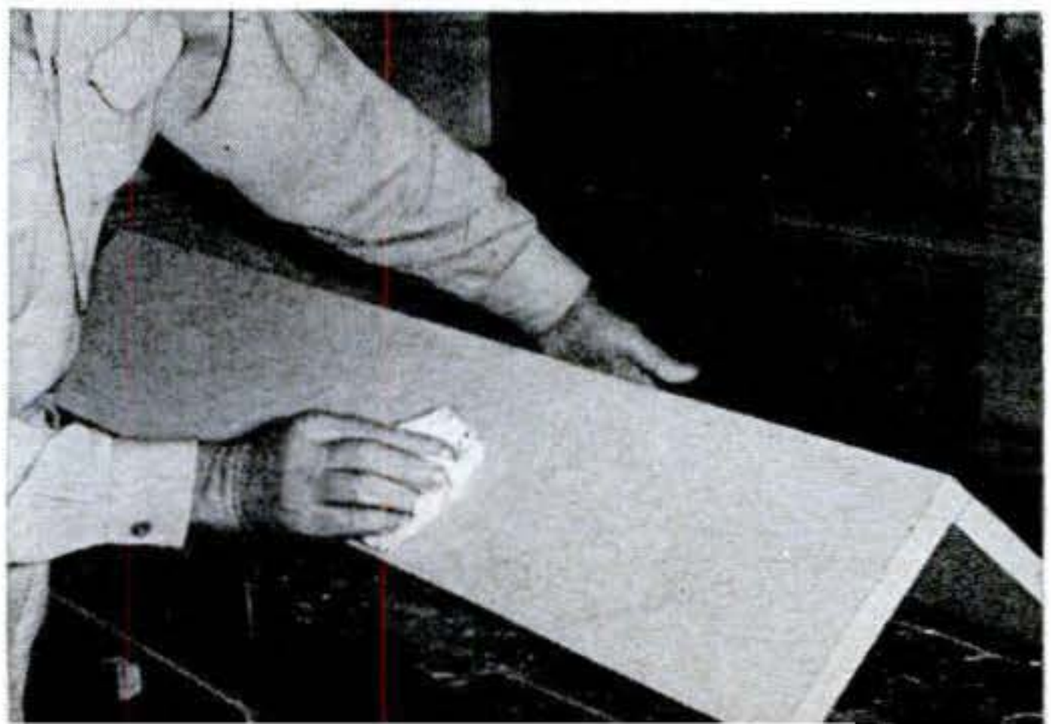


CUT SHELF NOTCHES at 45° in opposite directions in each pair of legs. Use a shelf to check notch width for a close fit. Cut one square notch for the top shelf, then three angled notches 9″ apart, and another straight one 7″ farther down for the lower shelf. Saw tops of the legs at an angle and round off the corners. For holding books only, omit the bottom shelf and space others out by cutting the notches 12″ apart.

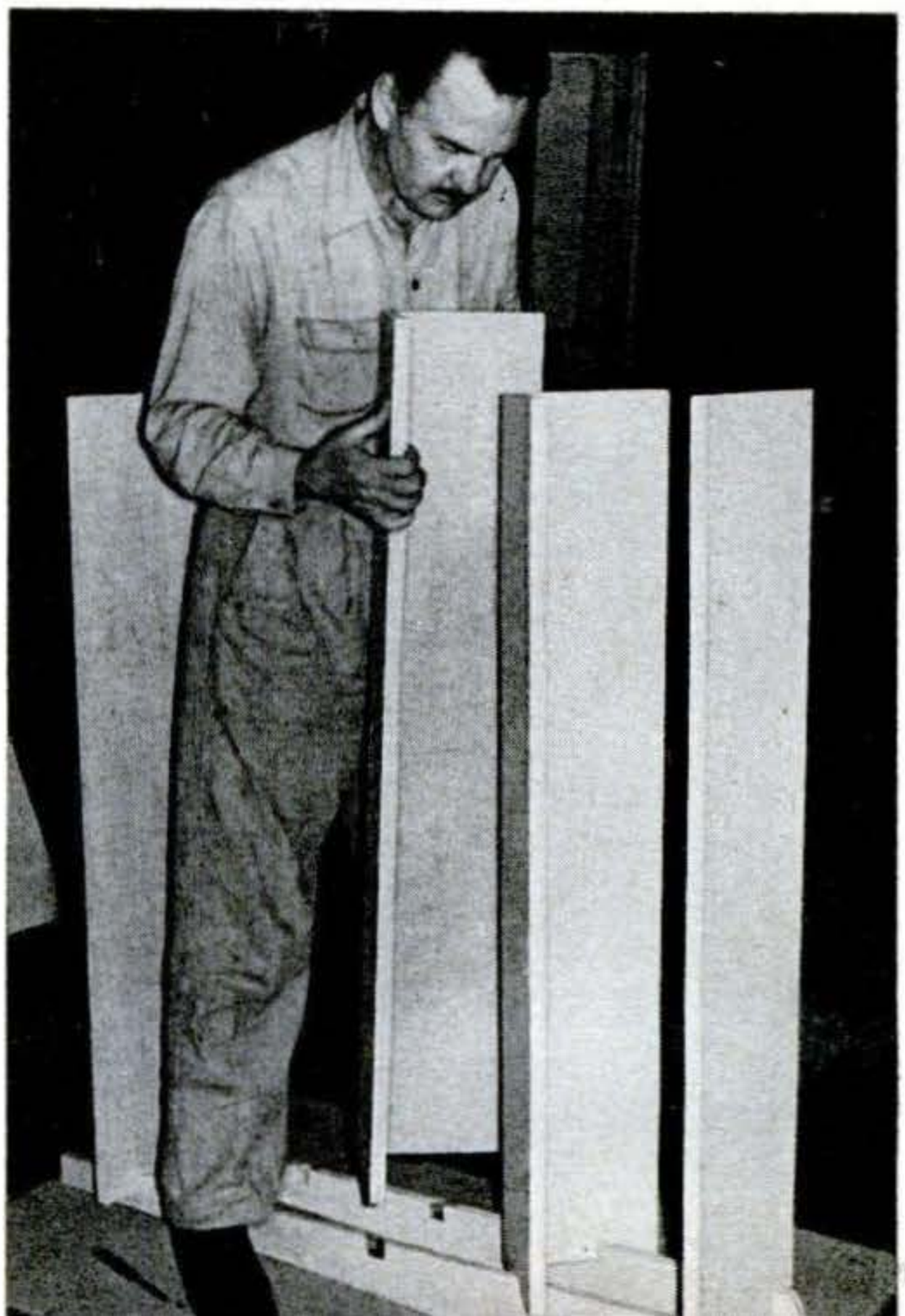


APPLY GLUE to one edge of an 8″ board and nail another to it with finishing nails like this. Wipe off surplus glue before setting aside to dry. Make three such shelf units.

FINISHING IS EASIER if done before the case is assembled. Ash wood used here was given a modern blond finish by coating with white filler, letting it dry a few minutes, and then wiping lengthwise with the grain. Cracks and nail holes were puttied beforehand.



PLACE TWO LEGS on the floor, notches up, smear glue into the notches, and insert the top and bottom shelves. Then drive the angle shelves into place, using a wood block under the hammer. Fit the other legs on top. Nails may be driven from under the straight shelves into the legs. If notches are a good fit, the unit can be assembled without glue and held with hooks and eyes in back, making it easy to take down for storage. END



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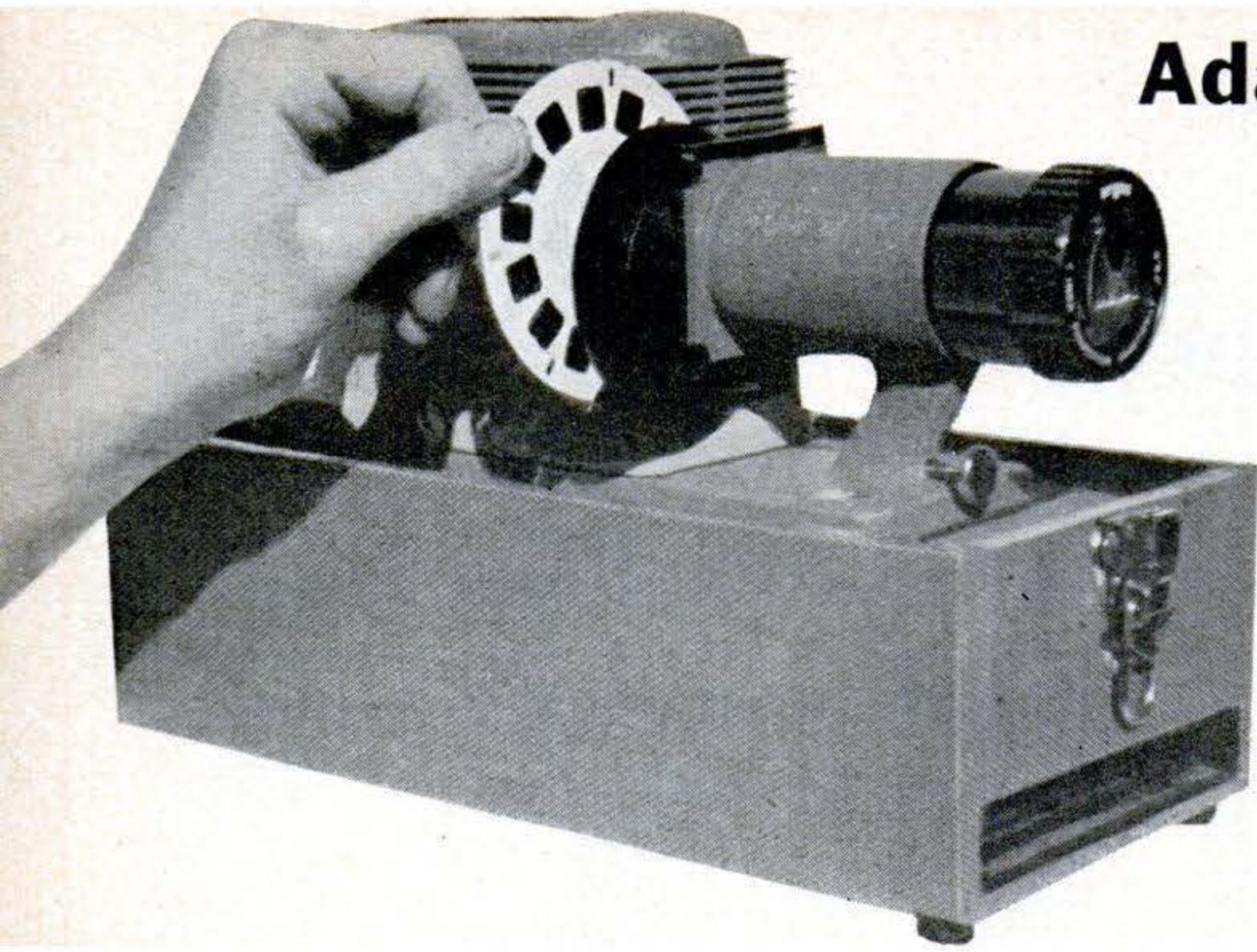
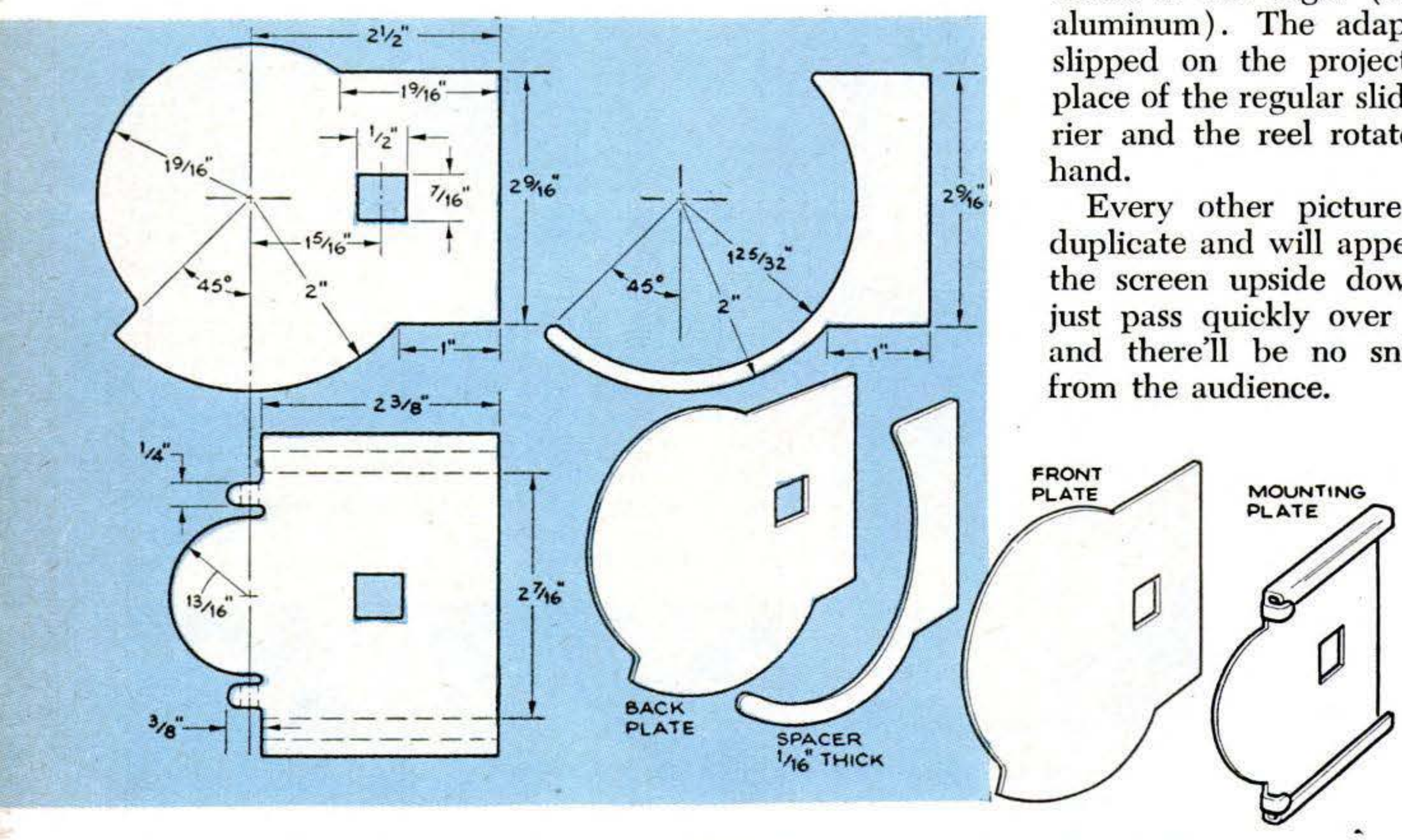


Adapter Projects Color Reels

EVEN if you shoot your own color, you've probably seen those small, inexpensive color reels, available for scenic spots all over the country, and wished you had some way to show them. With this simple adapter, you can show the reels in any standard 2"-by-2" slide projector, saving many times the cost of full-size slides.

The parts can be made of sheet brass, tin plate or aluminum, cut as shown and soldered at the edges (rivet if aluminum). The adapter is slipped on the projector in place of the regular slide carrier and the reel rotated by hand.

Every other picture is a duplicate and will appear on the screen upside down, so just pass quickly over these and there'll be no snickers from the audience.



Guide Aids Enlarging

SPIN this dial to a known exposure, and all new exposure times can be quickly found for any change in magnification or lens aperture during enlarging. By applying density measurements to the guide, it will also compute exposures without making tests for every print and will help select the right paper for each negative. The Enlarging Dataguide is made by the Eastman Kodak Co.

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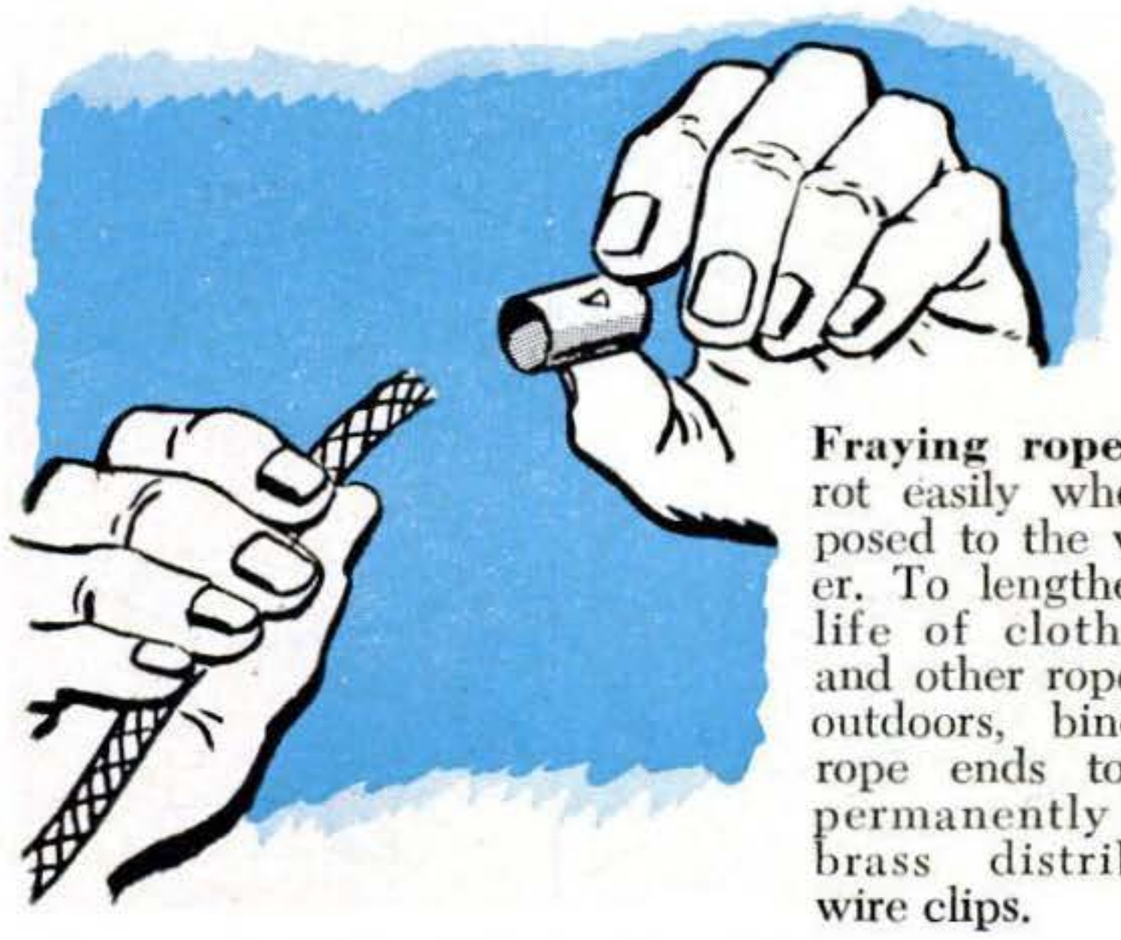
KEEPING THE Home SHIPSHAPE

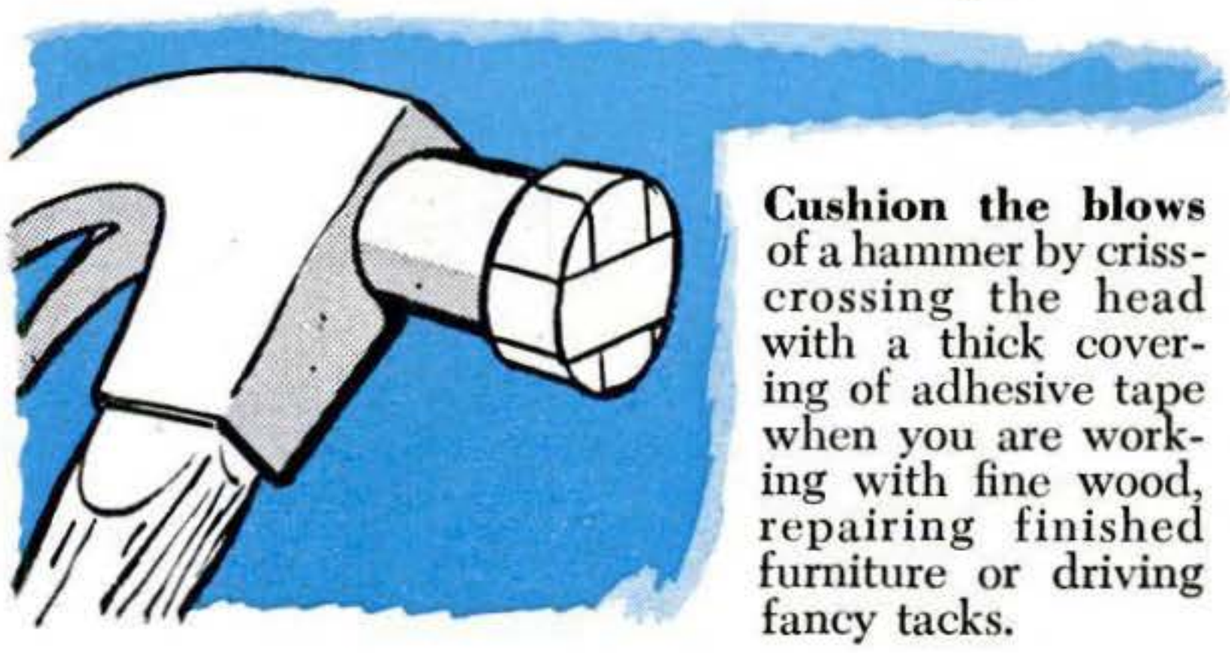
Nose a card table into a stall made of coat hooks and it won't slide to the floor when stored behind a door or against a closet wall. A pair of doorstops screwed into baseboard or floor will do the same job.

Tin-can frost protectors for small plants need not be weighted with rocks if teeth are clipped in the open ends. Some air will reach the plants if the teeth are not driven too deep into the soil.



Fraying rope ends rot easily when exposed to the weather. To lengthen the life of clothesline and other rope used outdoors, bind the rope ends together permanently with brass distributor-wire clips.

If a door sticks during wet weather, apply paraffin wax to the edge and to the jamb which meets it. The door will then be easier to manage until dry weather causes the wood to shrink again.



Cushion the blows of a hammer by criss-crossing the head with a thick covering of adhesive tape when you are working with fine wood, repairing finished furniture or driving fancy tacks.

Please turn the page for more home tips.

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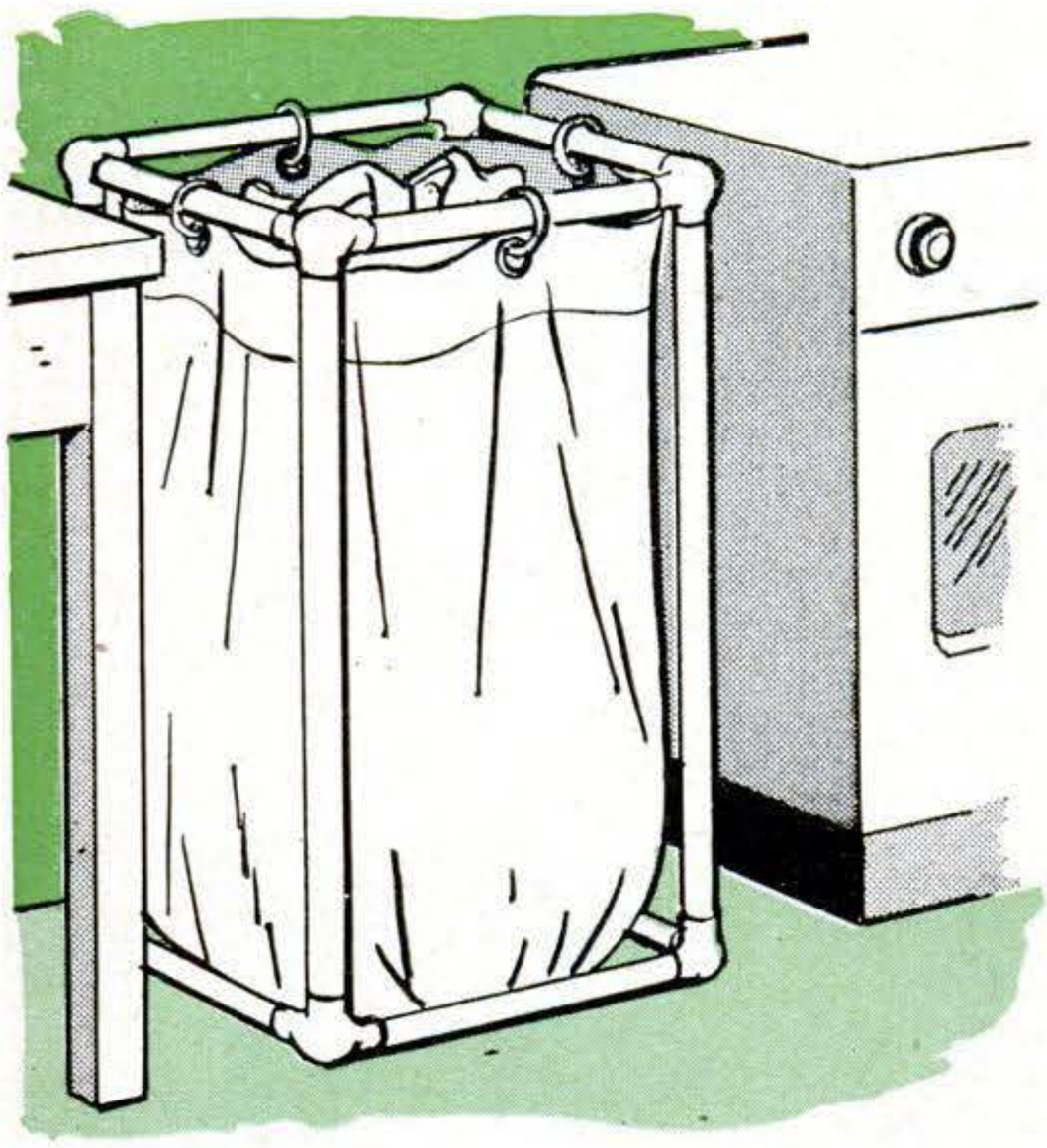
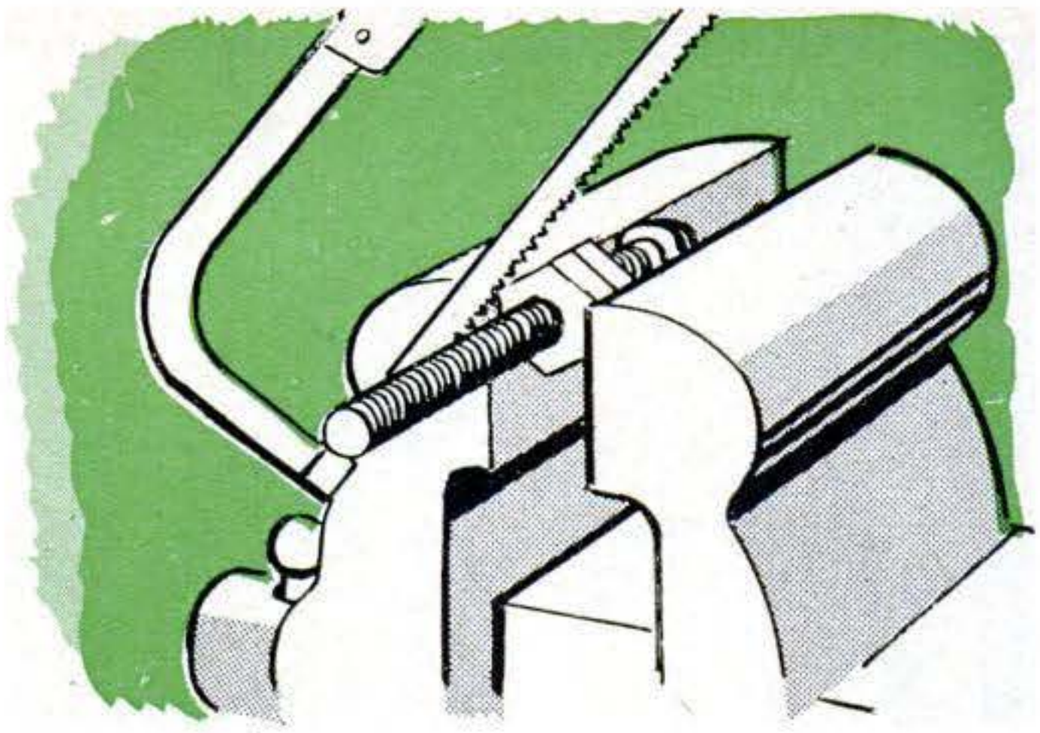
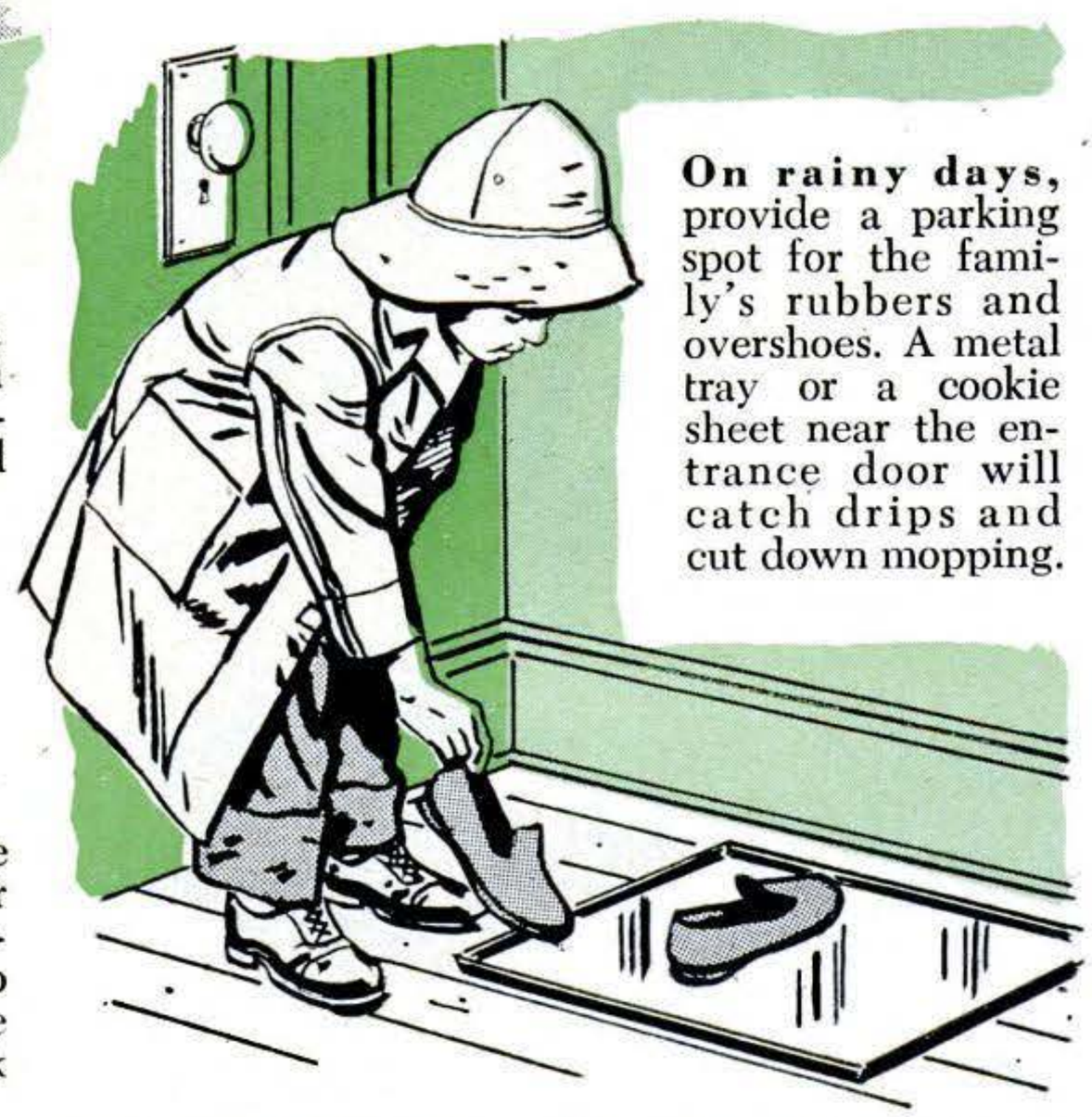
More Home Tips



A barracks bag hung with shower-curtain hooks on an iron-pipe stand makes a good hamper for a basement laundry. After wash-day, attach a clean bag on the stand to hold clothes awaiting ironing.



When shortening a bolt, screw on the nut before cutting into the threads. Then, when the nut is unscrewed, it will act as a die to smooth any ragged threads at the end.



On rainy days, provide a parking spot for the family's rubbers and overshoes. A metal tray or a cookie sheet near the entrance door will catch drips and cut down mopping.

To dust pillows, empty the feathers on a sheet, cover them with a screen and vacuum over the mesh. Change to a clean bag liner, suck up the feathers and dump them back into the ticking.

Building window boxes? To prevent wood rot, line them with heavy-duty aluminum foil before filling with soil. Fold the foil carefully at the corners so there are no tears exposing the wood.

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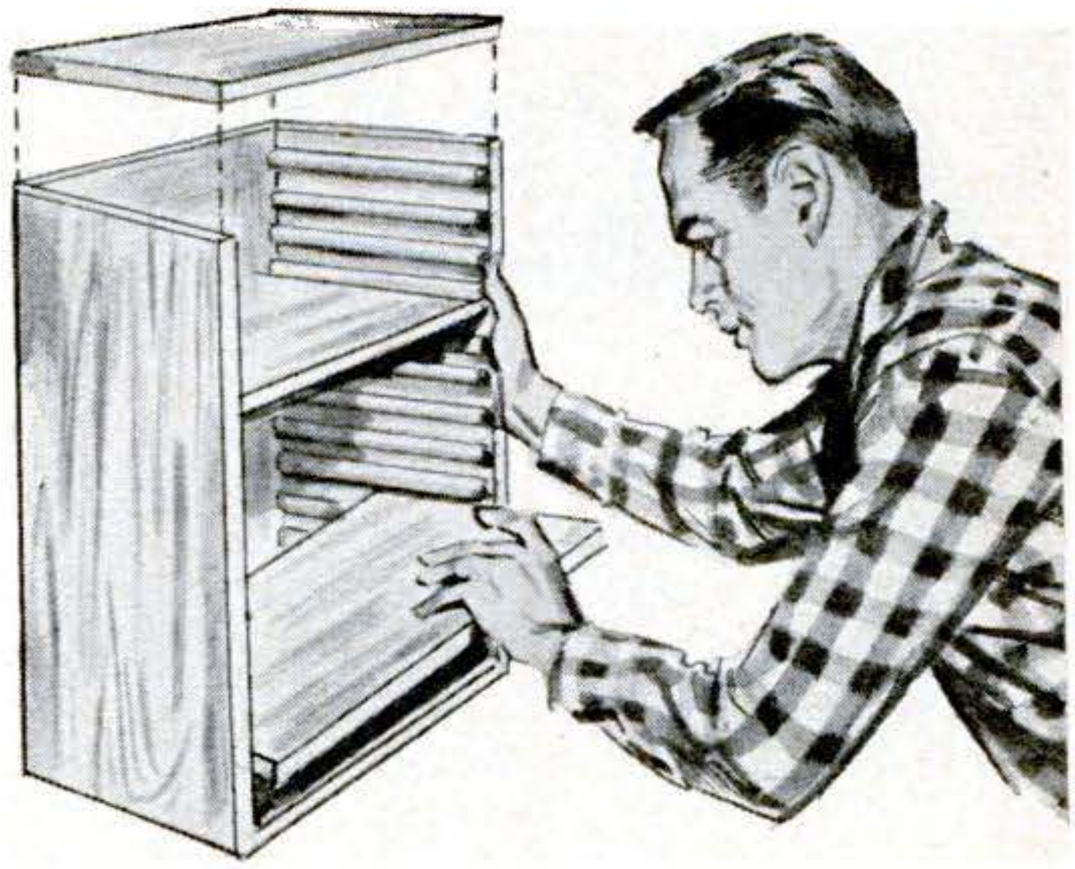
Felt Quiets Singing Guy Wires

ACTING like a finger on a vibrating violin string, a strip of heavy felt wrapped around a TV-antenna guy wire will damp vibration and lessen the tendency of the wire to "sing" when the wind blows.

Wrap a strip 6″ to 12″ long in a spiral around each wire halfway between the top and bottom. Secure ends with tape.

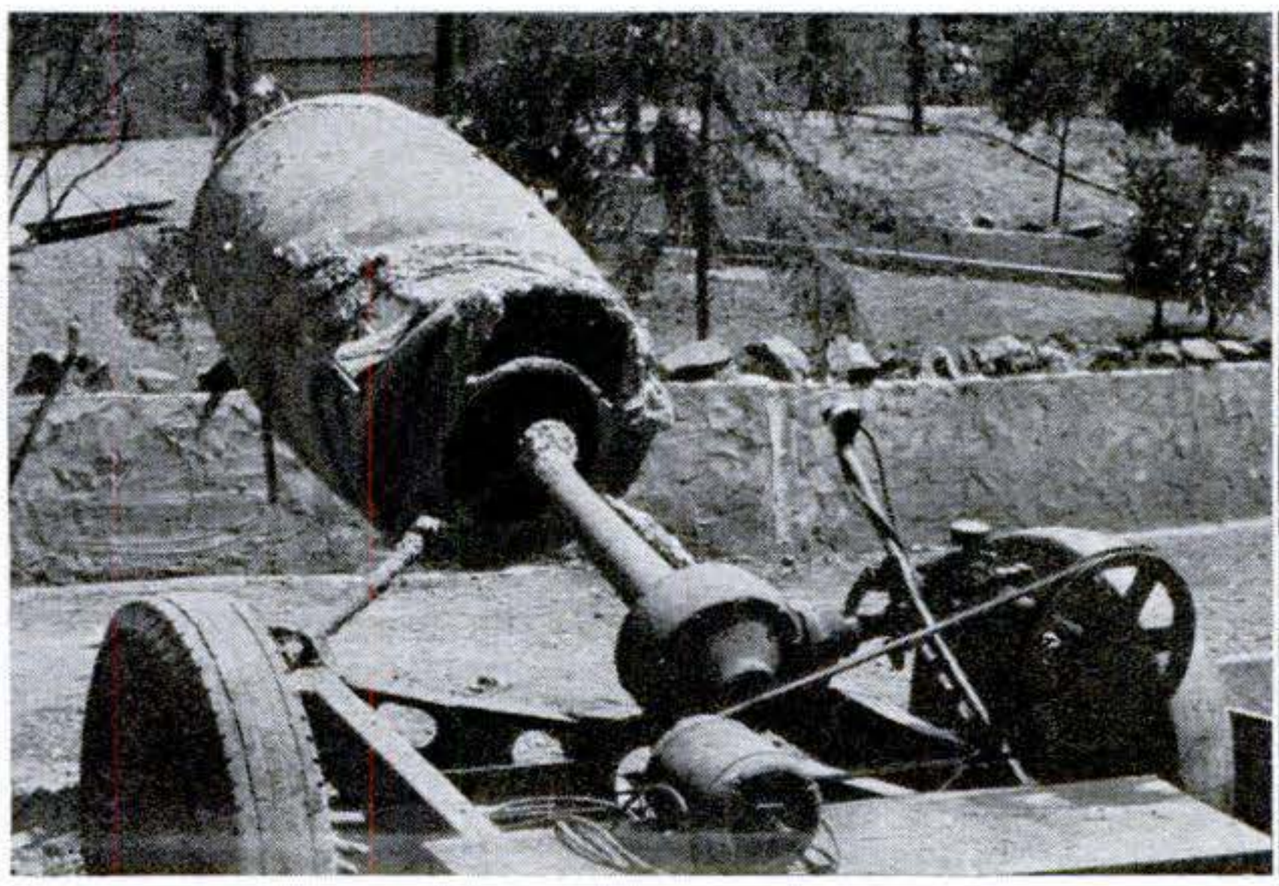
Container for Touch-Up Brush

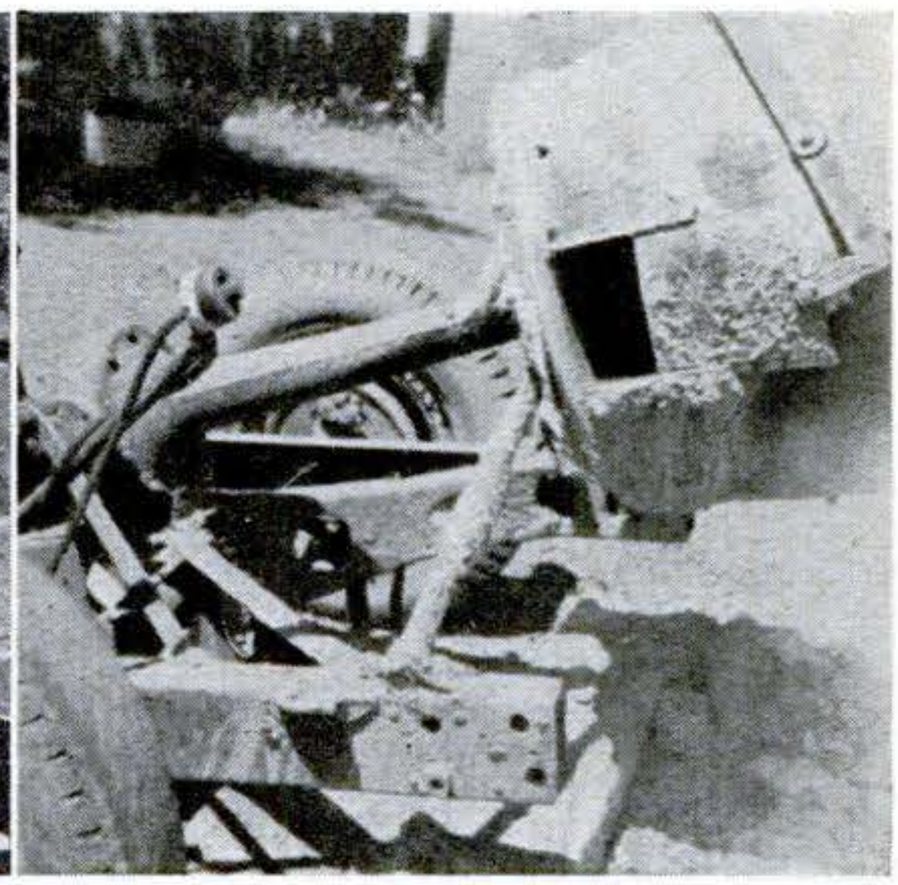
A CHEAP oilcan makes a handy touch-up paint can or small-parts cleaning unit. Unscrew the spout from the can, saw off near the hilt, and slide the brush up into it from the bottom side. Tape it if necessary.—*Ken Olin, Marquette, Mich.*



Corrugations Hold Shelves

YOU can make the shelves for your shop cabinets adjustable by fastening a piece of corrugated roofing to each side of a cabinet. Cut roofing the height and depth of the cabinet. Shelves, slightly rounded at each end, will slide into the corrugations.—*B. C. Vaughan Jr., Springdale, Ark.*





Model-A-Ford Parts Converted into Handy Cement Mixer

JUNK Ford parts that are no longer roadworthy can still see plenty of service mixing cement. The mixer above is an assembly of parts that requires no machining and only a little welding.

It is built on a section of a frame mounted on a front axle without springs. A plank bolted across the frame supports a ⅓-hp., 1,725-r.p.m. motor fitted with a 2″ pulley. Power is transmitted through a V belt to a 12″ pulley mounted on a worm-gear reduction box. A flexible coupling links this to the pinion shaft in the differential of half a rear axle. A Ford wishbone is used to support the housing of the axle.

Up at the mixer end of the outfit a rear-wheel brake drum is bolted on the axle and a 50-gallon oil drum is welded to it. A sheet-metal door, operated by a short lever, slides in two guides to cover the pouring opening while mixing. The mixer is controlled by a heavy-duty switch mounted on a bracket near the drum. A length of 2″ pipe fitted with a trailer hitch permits towing the mixer to the job.

Capacity is about two wheelbarrow loads, and mixing time is about five minutes for each batch.—*S. White, Forestville, Calif.*

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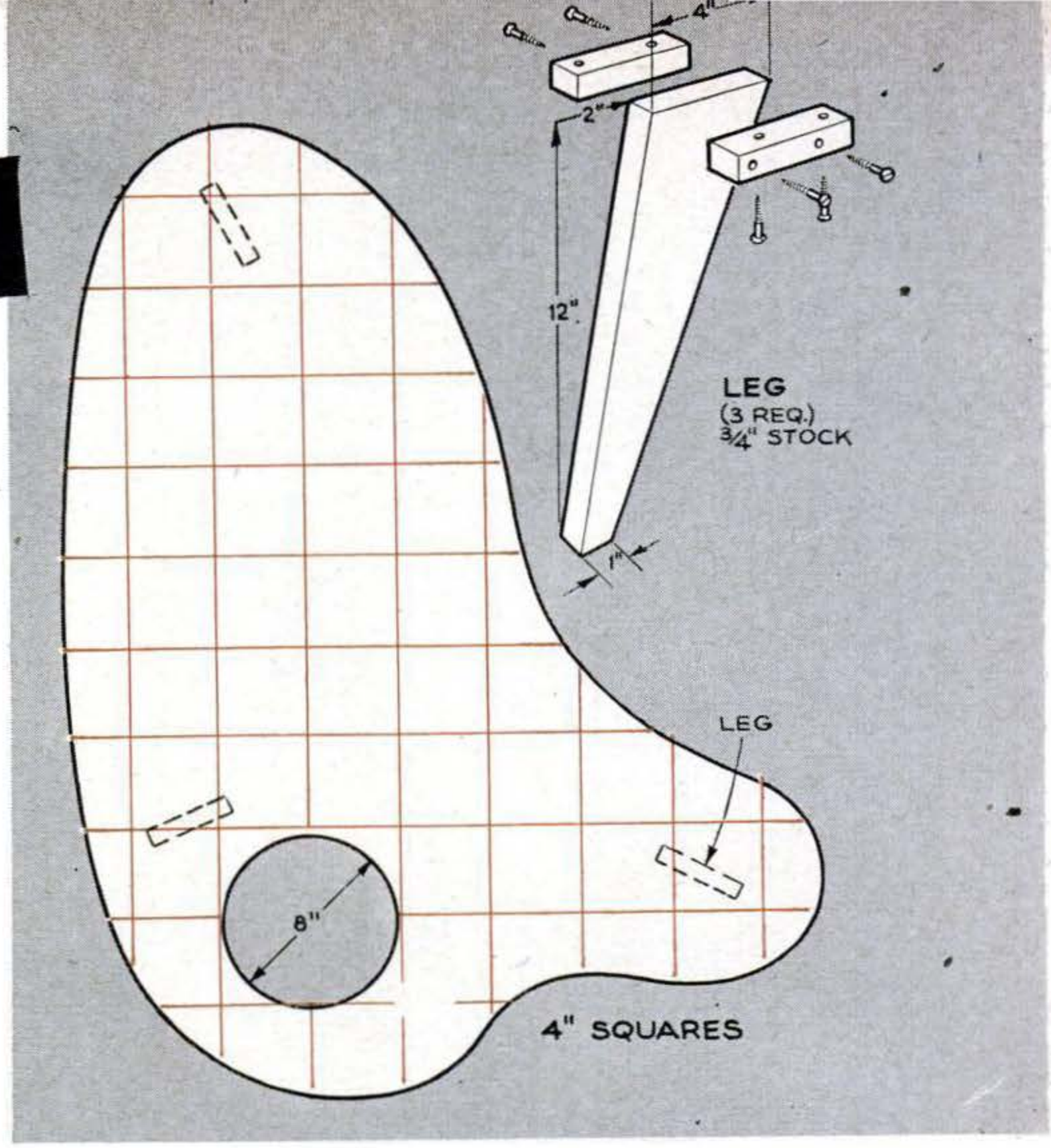
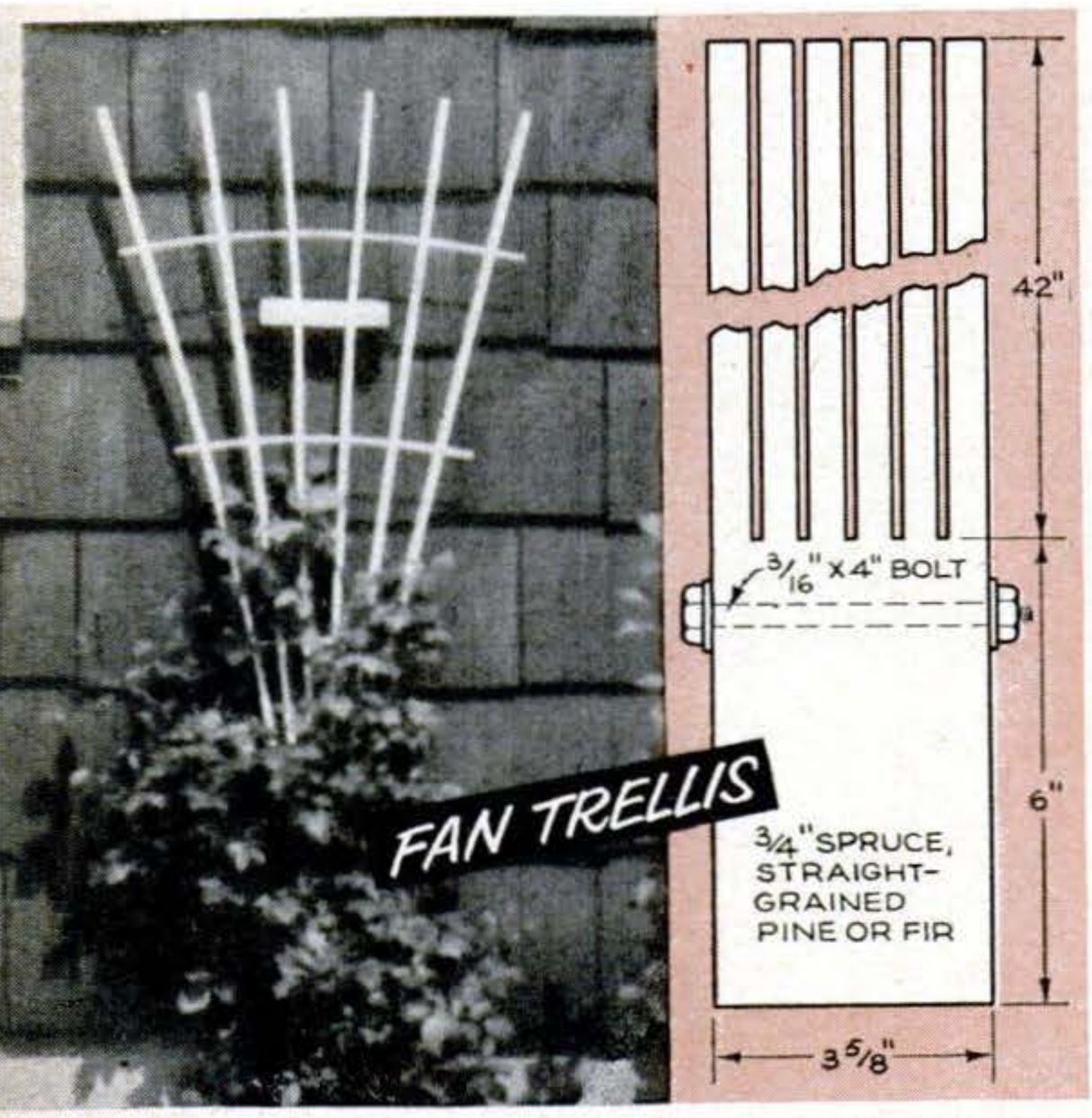
One Evening Shop Projects



Smart as it looks, the table on the opposite page can be built in about four hours. The cutout will hold either a potted plant or a bowl for fruit or snacks.

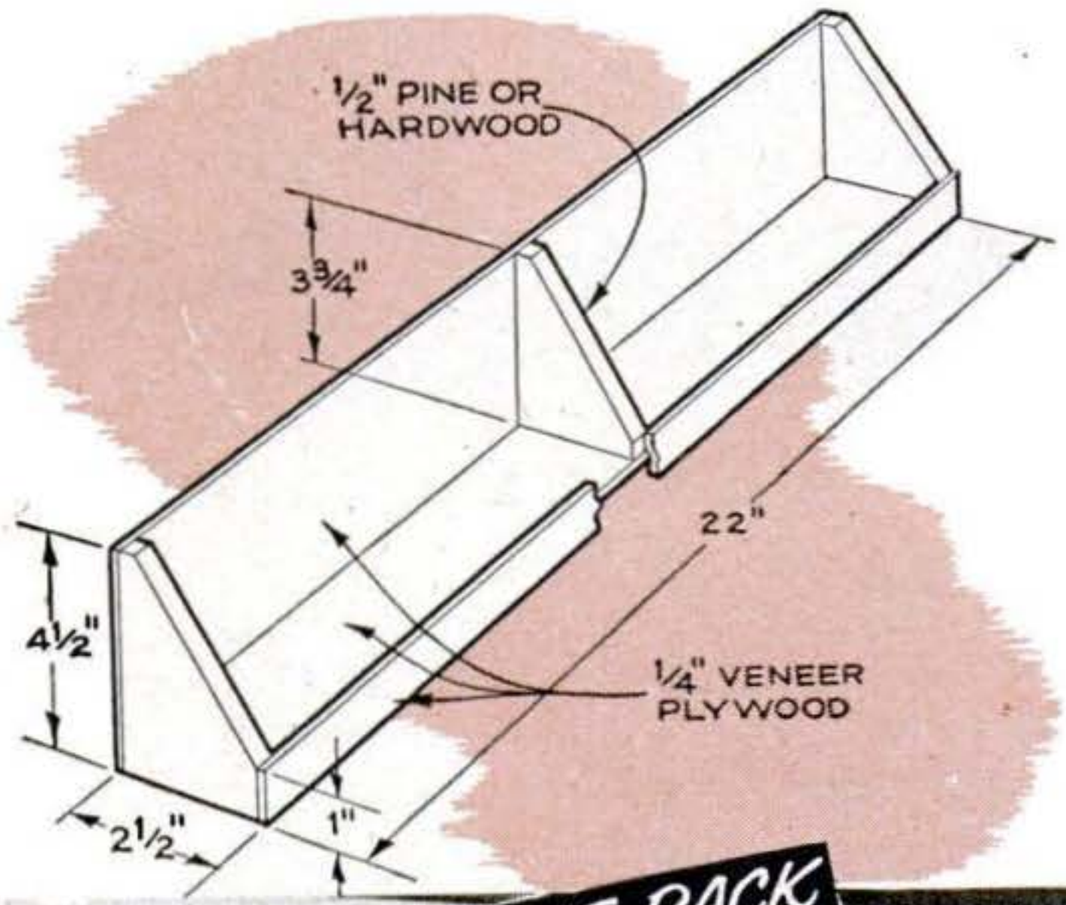
Drawn on 4″ squares, the pattern will be about 32″ by 44″. Use larger or smaller squares to get the size desired. Cut the hole to fit the container you wish to use.

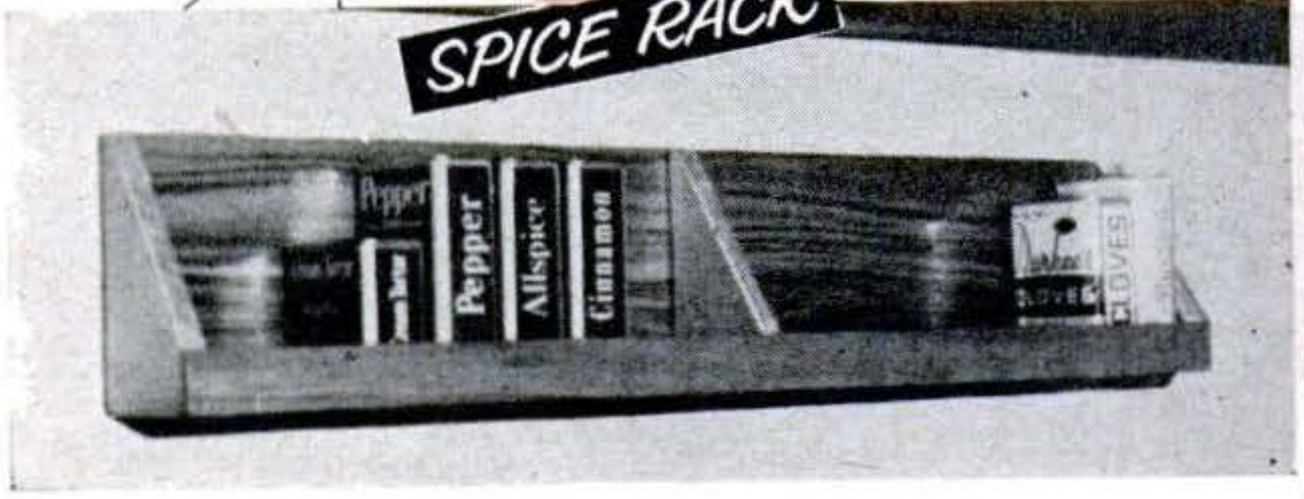
The legs are held by small blocks secured to the underside of the top with glue and 1¼″ No. 8 screws, staggered to avoid interference. A natural lacquer or varnish finish with a black edge is good in modern interiors. *—R. T. West, White Plains, N. Y.*



Climbing plants will just naturally take to this trellis. Rip five evenly spaced kerfs in a straight-grained ¾″ board 4′ long. Tighten a bolt across below them to prevent splitting. Pull the ends 4″ apart and nail on spreader strips bent to a curve. Paint white for contrast, or green to blend with foliage.*—Hi Sibley, Nuevo, Calif.*

Mounted near the oven, this rack keeps spices in cooking reach. Use veneer plywood for a grained finish, fir plywood for a painted one. Cut the middle brace lower than the ends to fit inside. Glue and nail. *—W. R. Patjens, Spanaway, Wash.*





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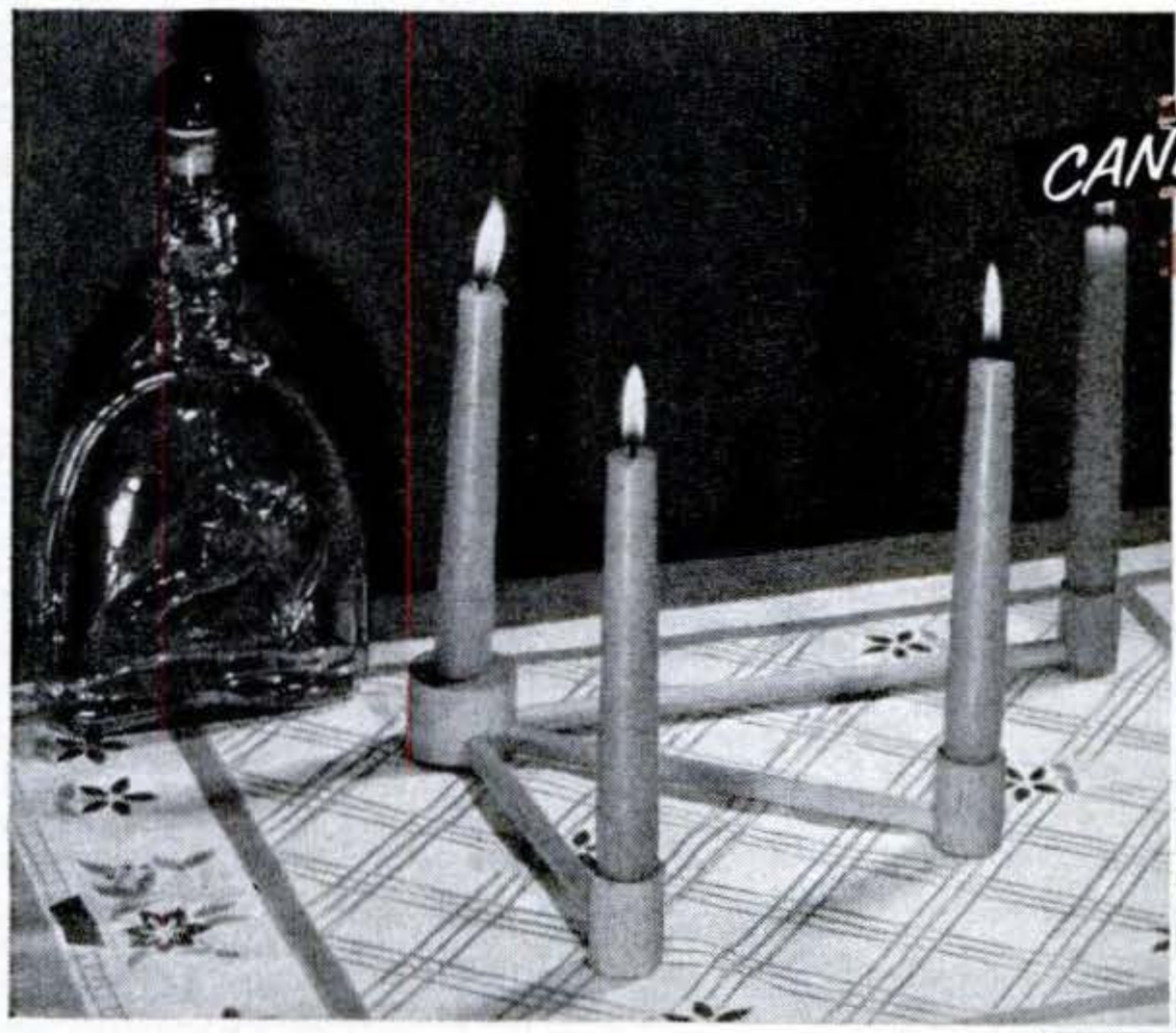
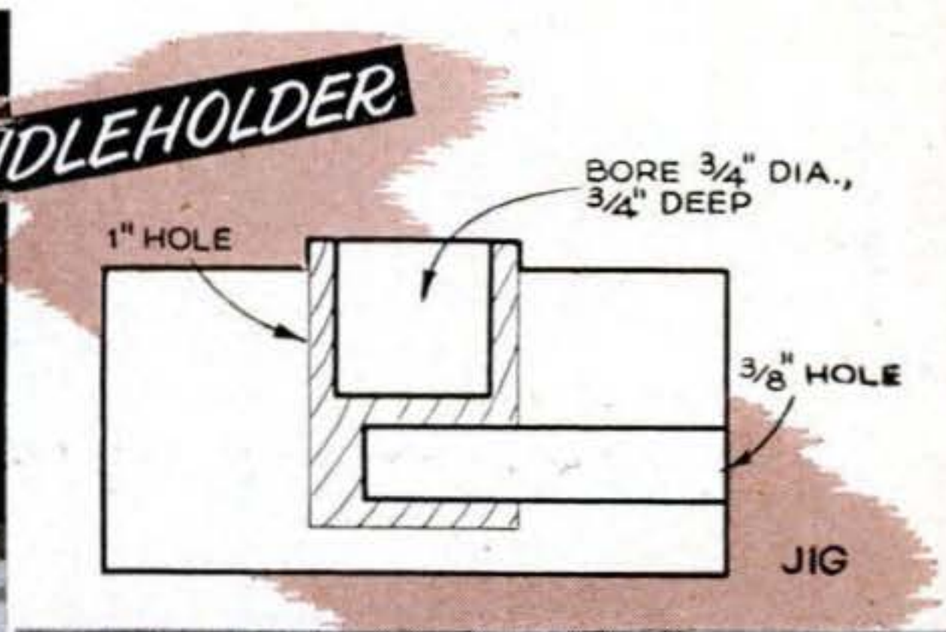
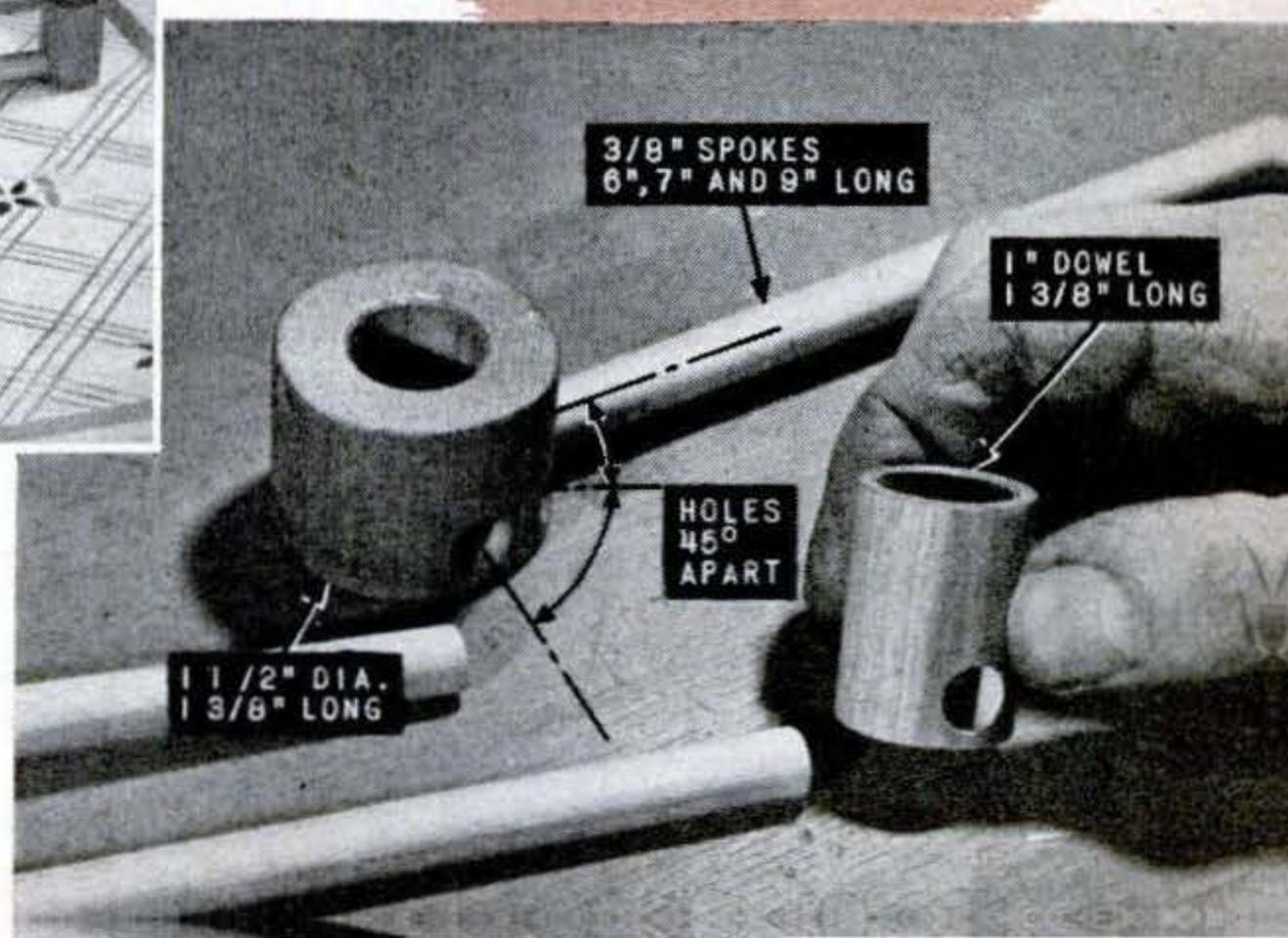
Bore a few holes in some scraps of maple doweling and you have a provincial-style candleholder. A simple jig makes it easy.

Cut the socket pieces square and to length. Push each one into the jig, drill the spoke hole, insert a ⅜″ dowel to keep the piece from turning, and bore the ¾″ hole, centering it carefully.

A similar jig can be used to bore the spoke holes in the hub socket. Make a mark on it and the block, and turn the piece 45° between holes.—*Walter E. Burton, Akron.*







LARGE HUB SOCKET can be 1½″ dowel, a bit of handrail stock or curtain pole, or even a square or octagonal block instead of round. For a natural finish, simply wax and polish after sanding the parts smooth.

You can learn some new tricks by

Machining Your Own Milling Attachment

By Harry Walton

YOU do not begin to get full use from a lathe until you have a milling attachment. With it you can do slotting, keyway cutting, gear shaping, slitting and grooving. You can saw stock square or at angles, and spot holes in work with pinpoint accuracy.

A milling attachment costs a handful of folding money. But here is one you can make from two castings. They cost about a fourth what a finished attachment would. Machining them is fun, and may even teach you a few handy dodges. For instance, you mill parts of the castings to make the attachment you're going to mill with!

When finished you have a husky, well-designed lathe accessory that will not let

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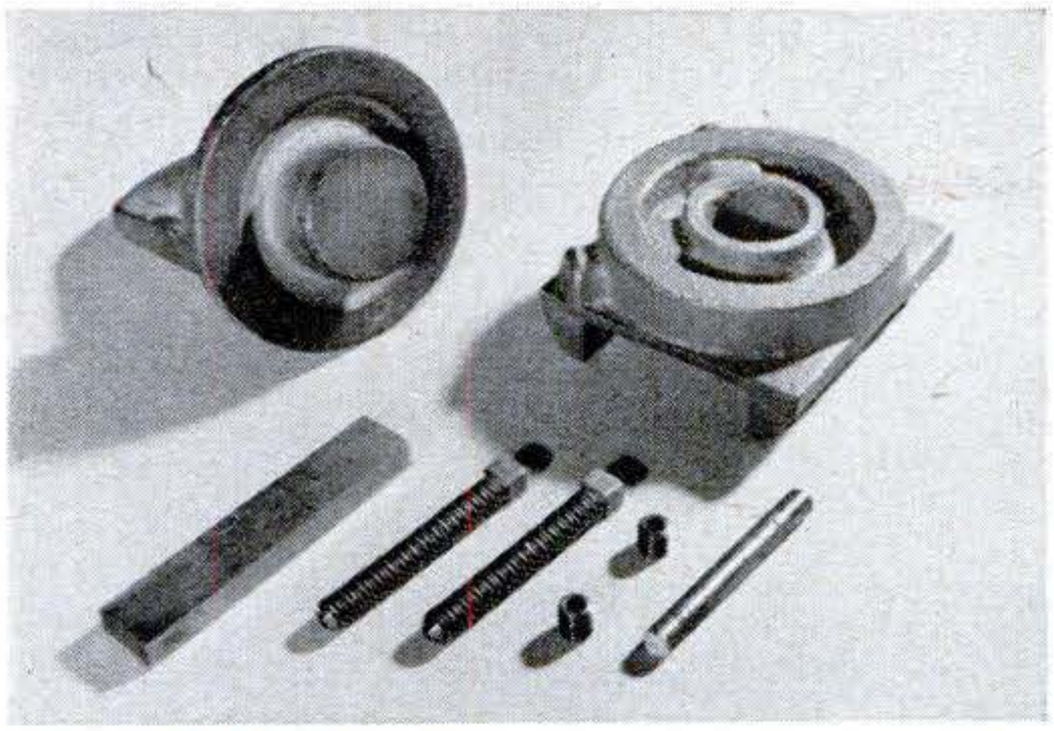
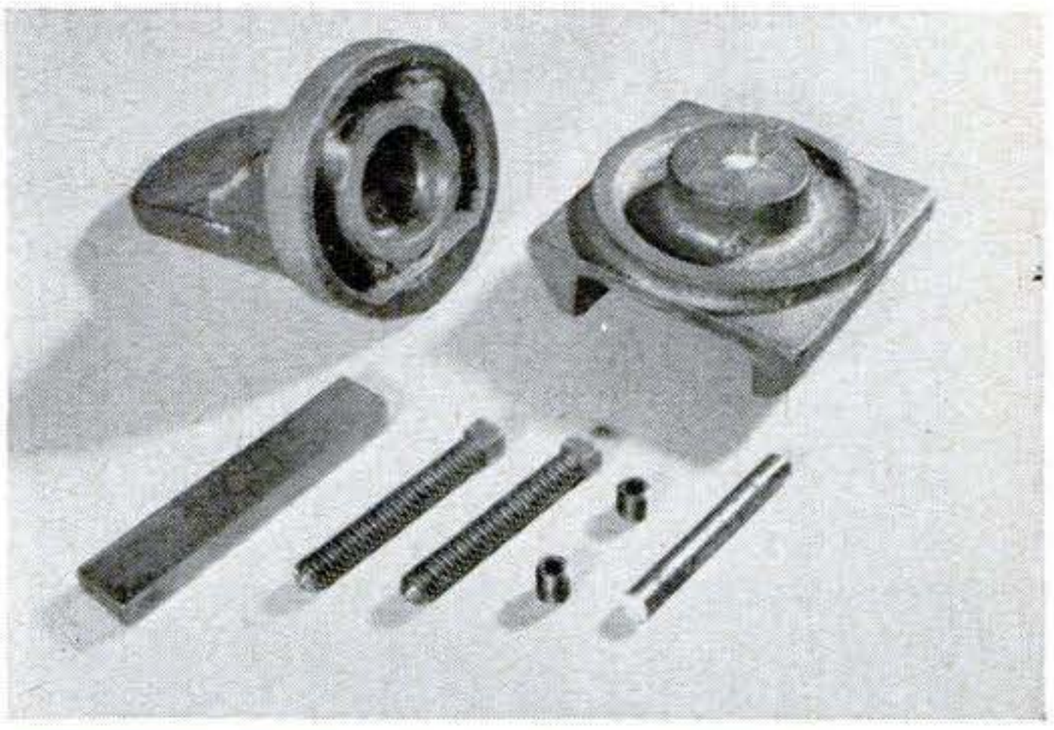
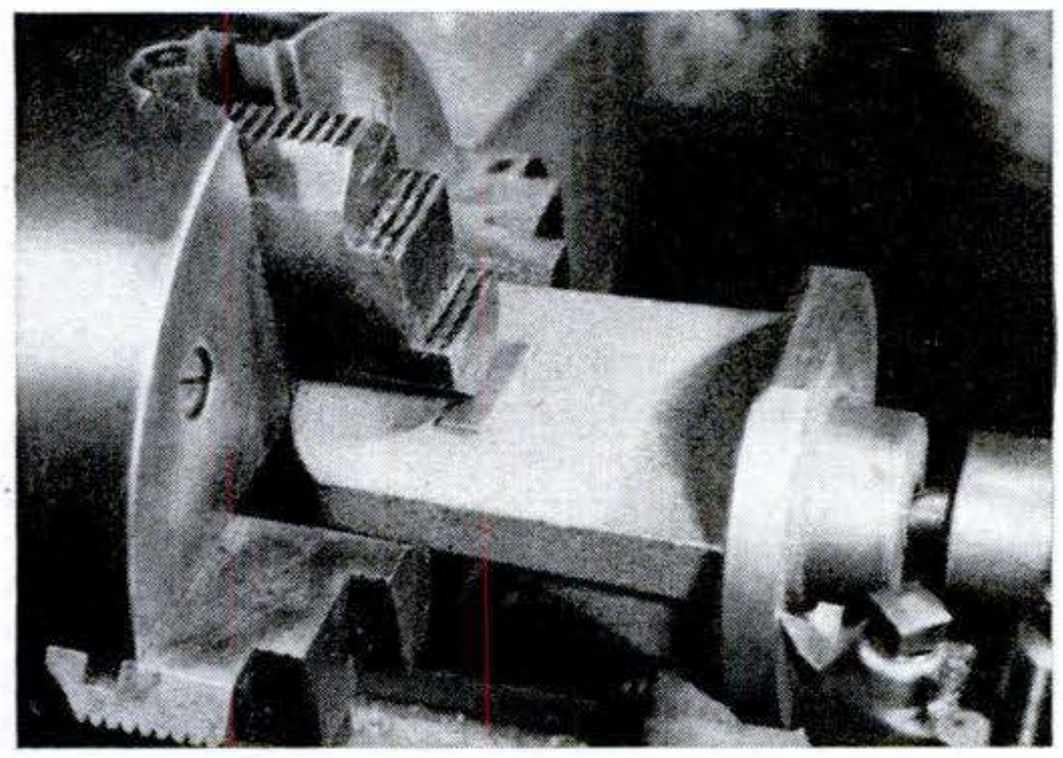
Two kinds of castings fit different compound mountings



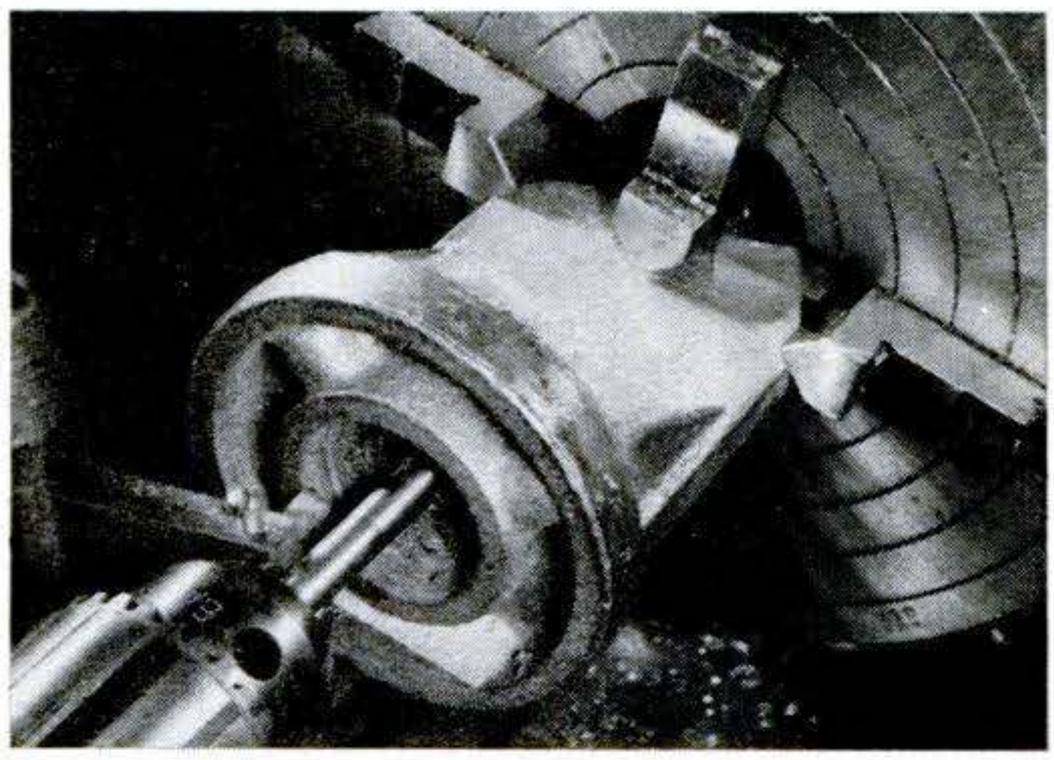
HERE ARE CASTINGS for a popular 9″ lathe having the dovetail post on the underside of its compound rest and a recess in the top of the cross slide. The base casting (at left above) therefore has metal for a similar post, while the vise casting to right of it has a cored hole to be bored out for a recess.



OPPOSITE TYPE of castings will fit a popular 10″ lathe, which has the dovetail post on top of the cross slide and a recess to fit it in the compound rest. The base casting (at left above) therefore has a cored recess. Vise casting has metal for a post. Kits include screws and stock for vise jaw and locking pins.



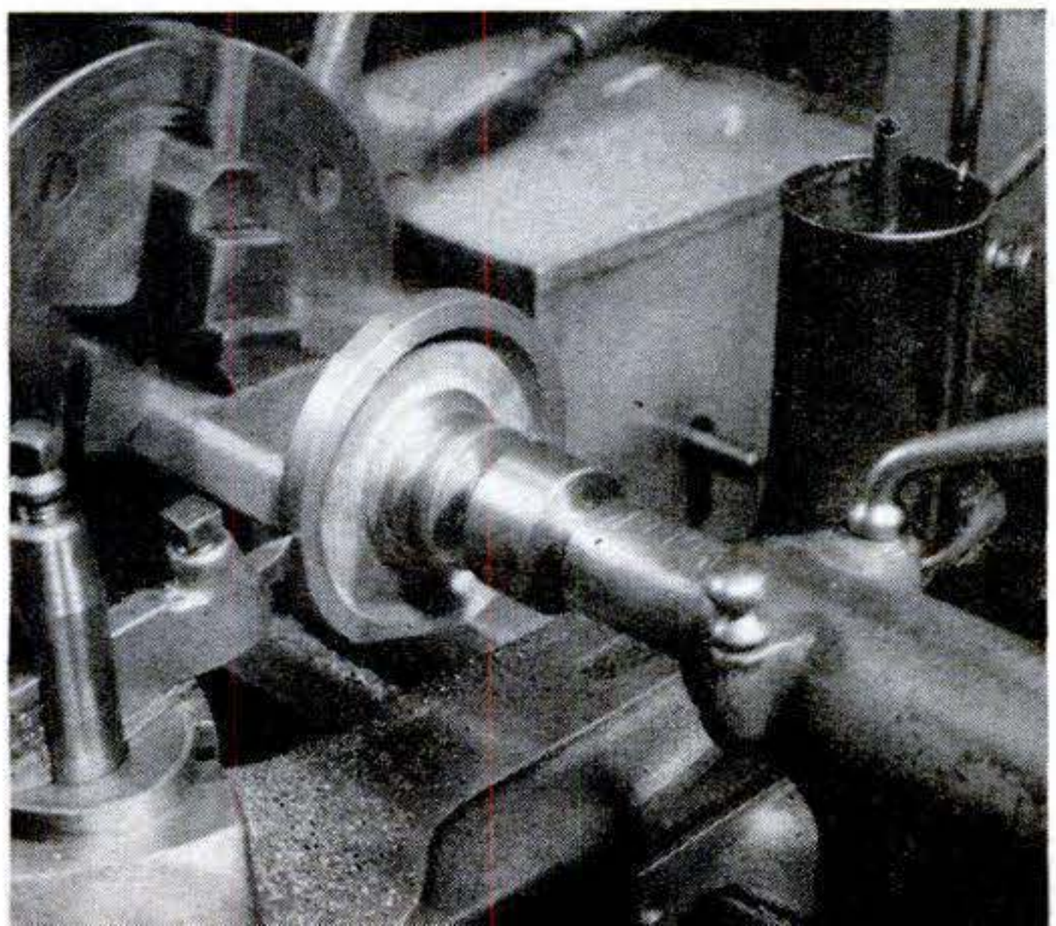
GRIP THE BASE in a four-jaw chuck if available, centering it to make round end run fairly true. A universal chuck can be used by laying a bar of suitable thickness across two jaws. Centerdrill the outer end deeply and engage the tailstock center to support it.

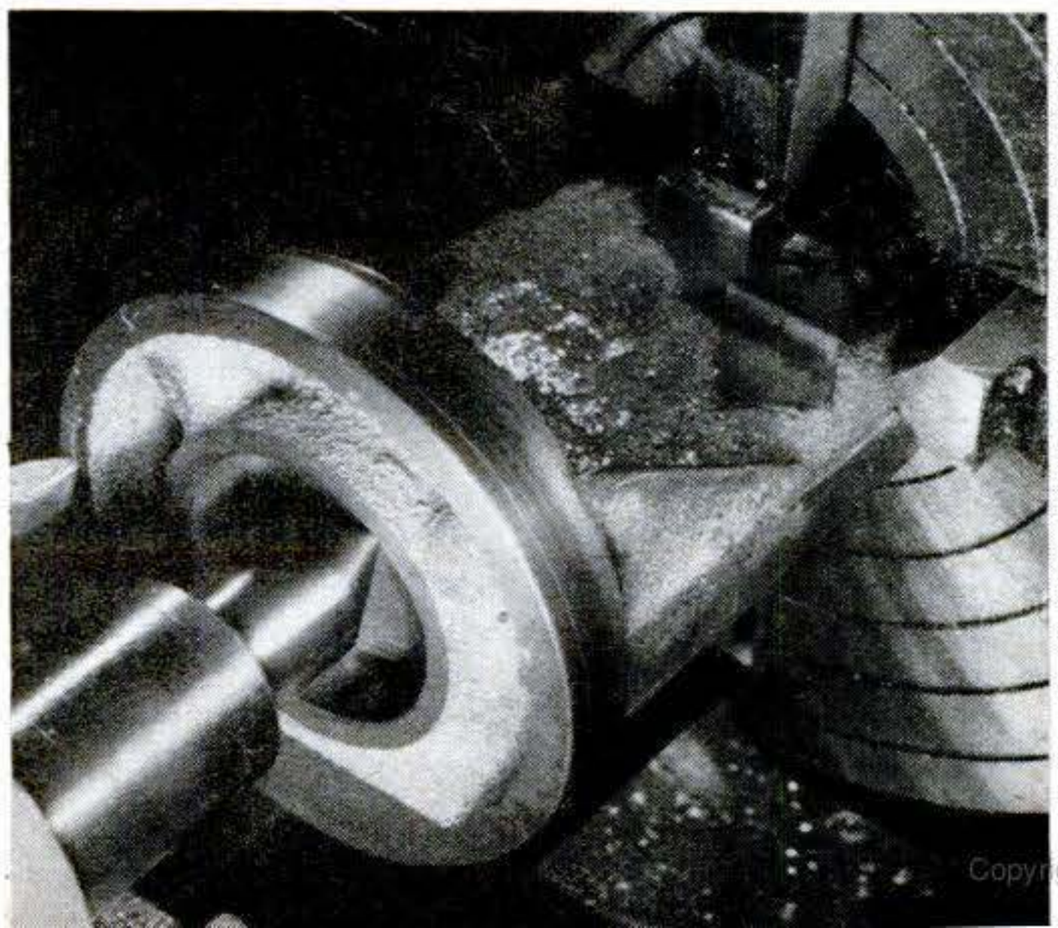


TURN A 60° POINT on a ⅜″ rod. Chuck the base casting, centerdrill deeply, and support it with the pointed rod in the tailstock. Bore recess a close fit on the cross-slide post. For the offset tool shown, clamp a bit with a setscrew in a hole drilled across a ⅜″ bar.

ROUGH OUT with a fairly deep cut at low speed to get under casting scale. Swing the compound rest to 30° and turn post to same shape as that on the compound. Face off the bottom to leave post the same height also. Finally, turn outer rim of the base true.

FACE OFF with a cut straight across from recess to rim. Be careful not to remove much metal after first deep cut to get under scale, or recess may become too shallow for the post. Recess is cored deeply enough not to require facing inside if carefully machined.





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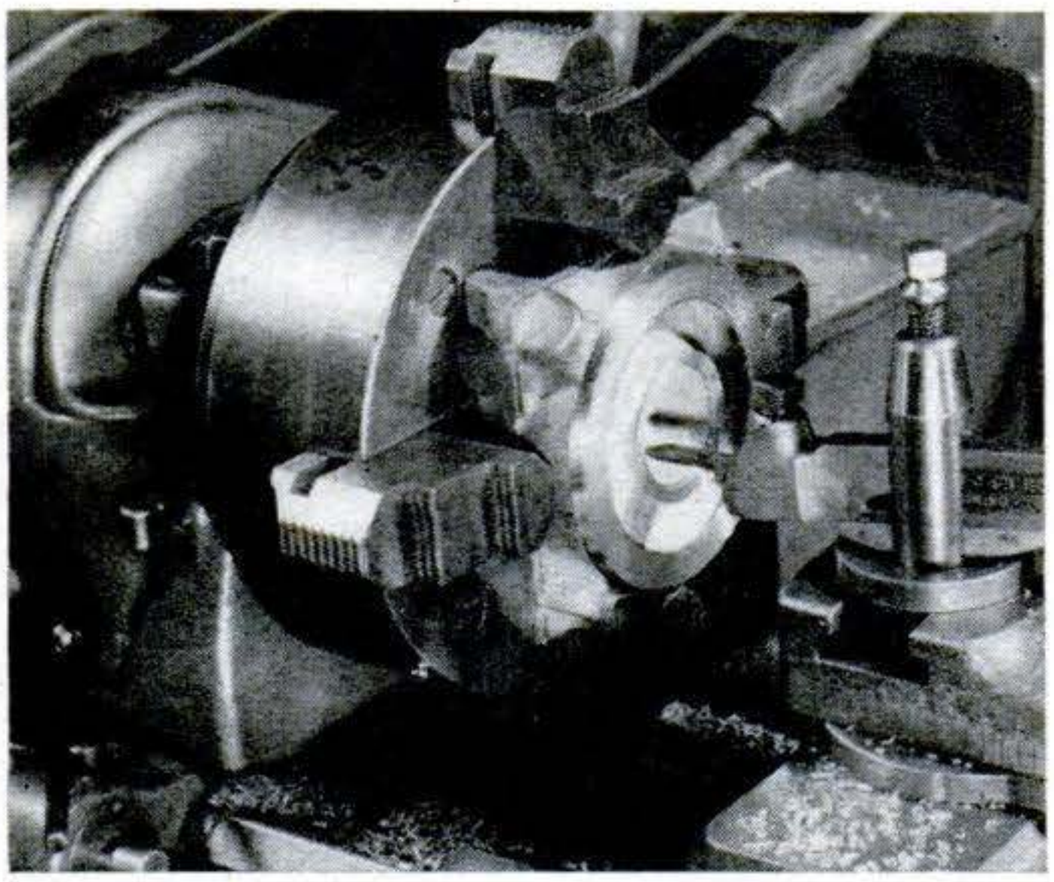
you down. The castings are plenty rugged, and there is only ⅞″ overhang between the outside of the vise and the base. This remarkably small offset reduces the tendency to chatter, which otherwise means milling at a snail's pace with light cuts, or getting a rough finish.

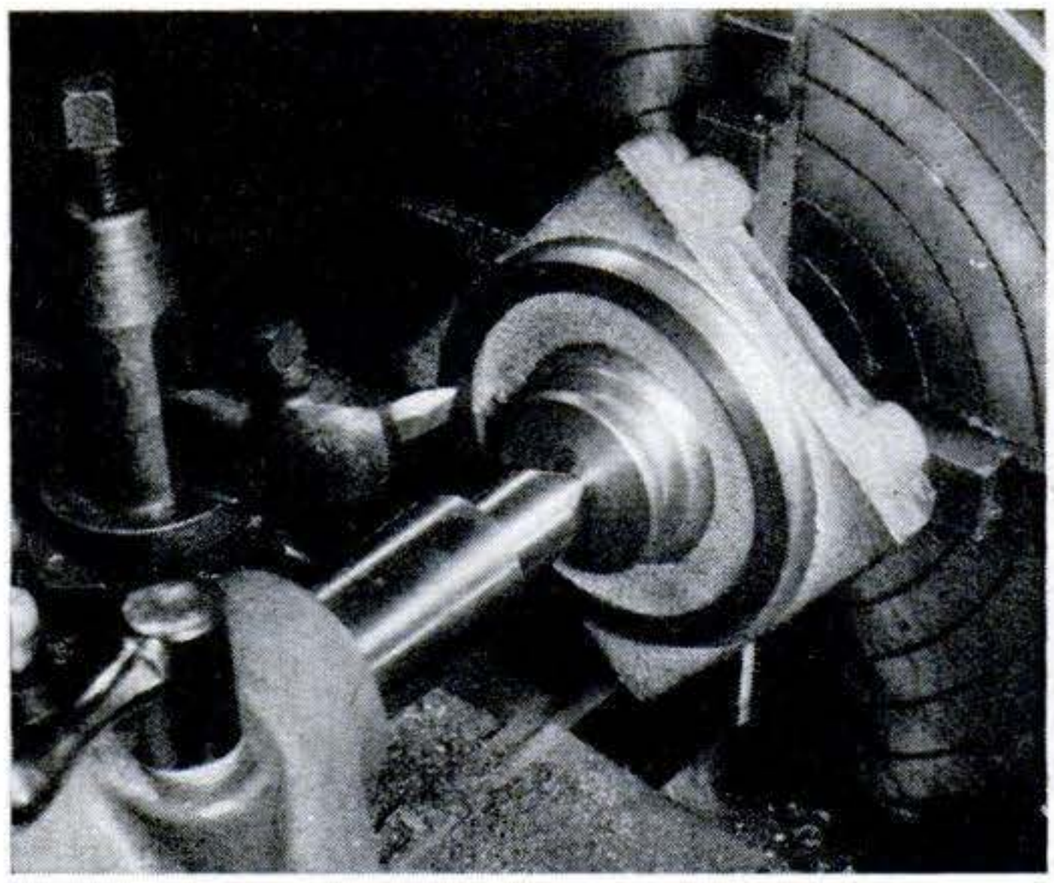
The jaws are 3½″ wide and they open to 2″. Both the vise and the base can be swiveled for angular milling, as shown in the large photo on page 214.

What makes construction easy is the neat trick of using the compound rest for the vertical milling feed. The base casting fits on the cross slide, the compound is clamped on it in an upright position and the vise is mounted on the compound. Castings are available* for 9″ and 10″ lathes, and for both the common compound mountings. To check yours, just take off the compound.

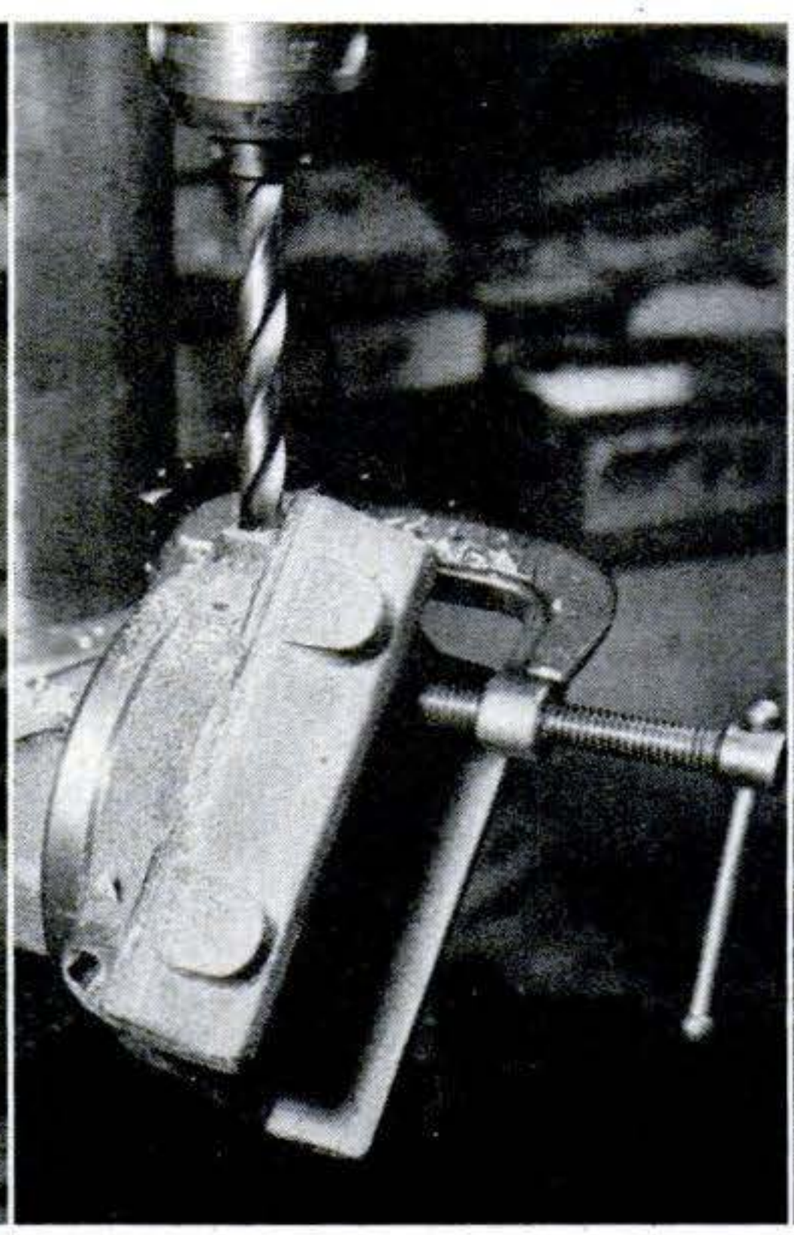
**Sold by Floyd McGuckin, 314 N. Monroe Ave., Ridgewood, N.J.; $7.50 postpaid.*

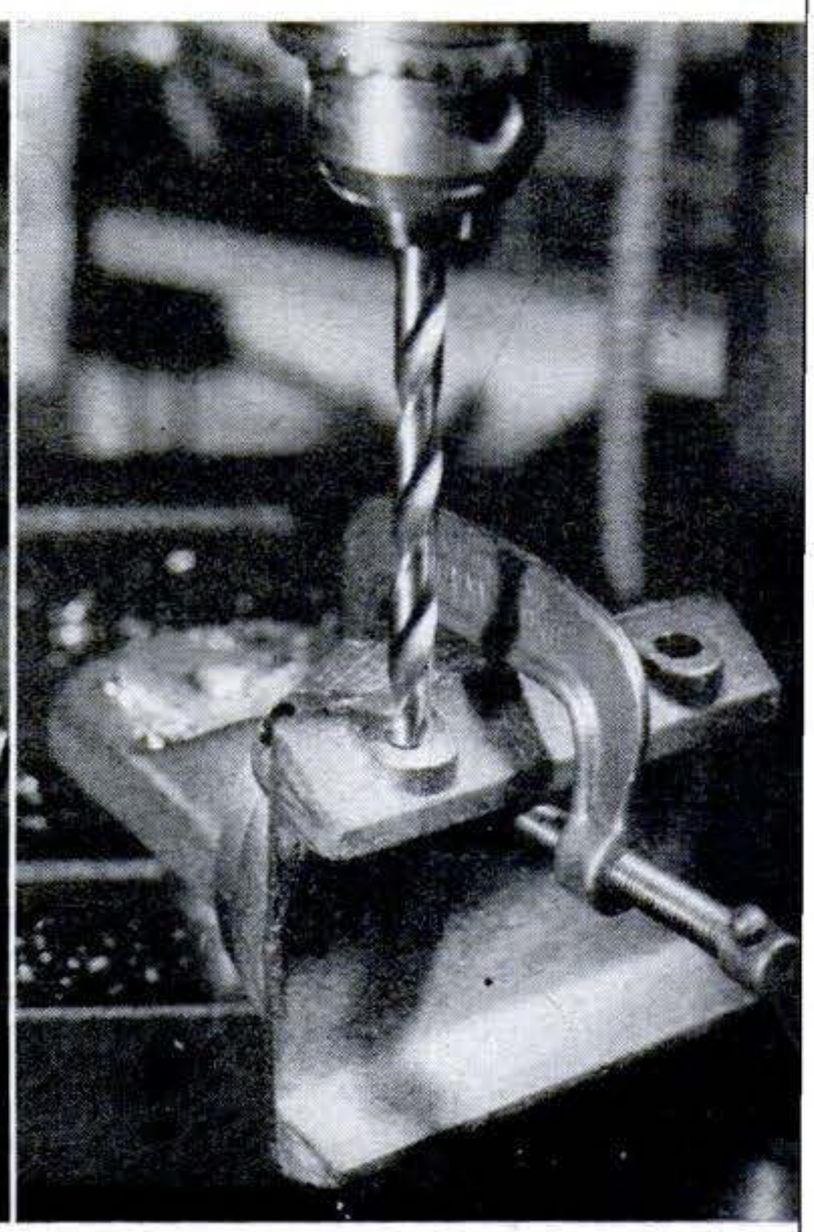


VISE CASTING can be gripped with chuck jaws either outside as above, or inside its own jaws as at right. Bore the recessed type a close fit for the compound post. Then face off, taking care to leave recess deep enough.



OTHER TYPE of vise casting is first center-drilled for tailstock support. Then the compound is swung to 30° for turning the post to a duplicate of the one on the cross slide. Facing (above) completes work on this side.





MOUNT POST-TYPE BASE on the drill press as above, align drill on the slope and set the depth stop short of it. Clamp the vise on as in the center photo. Drill 5/16″, remove vise to drill into recess, and tap ⅜″-16. Then reclamp the vise on the base to drill screw holes through the bosses provided (right above). The recess type of base is itself tapped for screws. Cut and shape locking pins, chamfering 60° corners to prevent burring.

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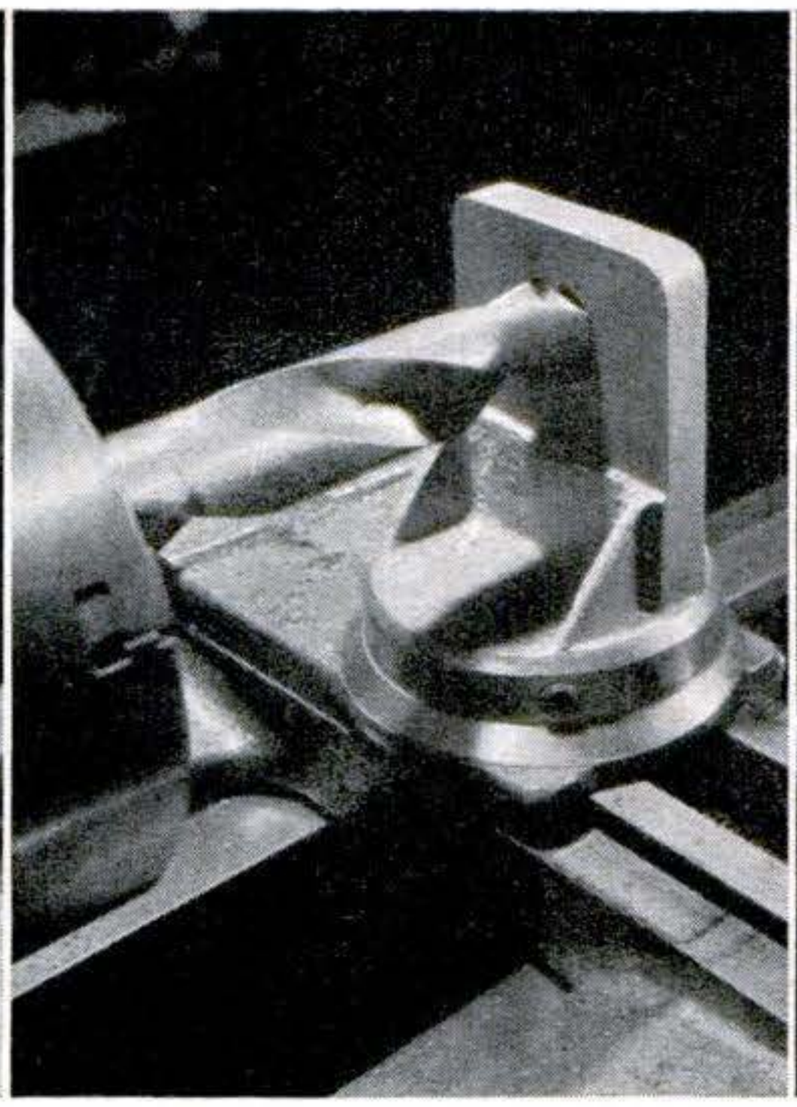
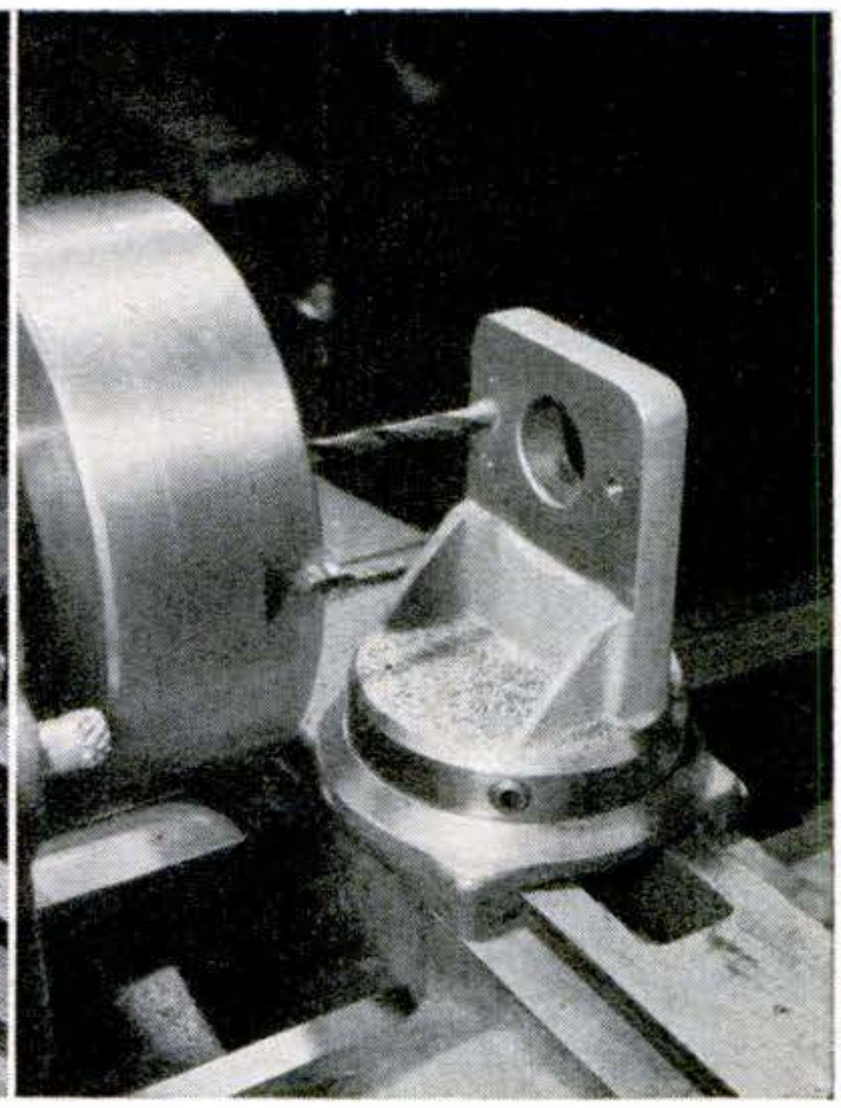
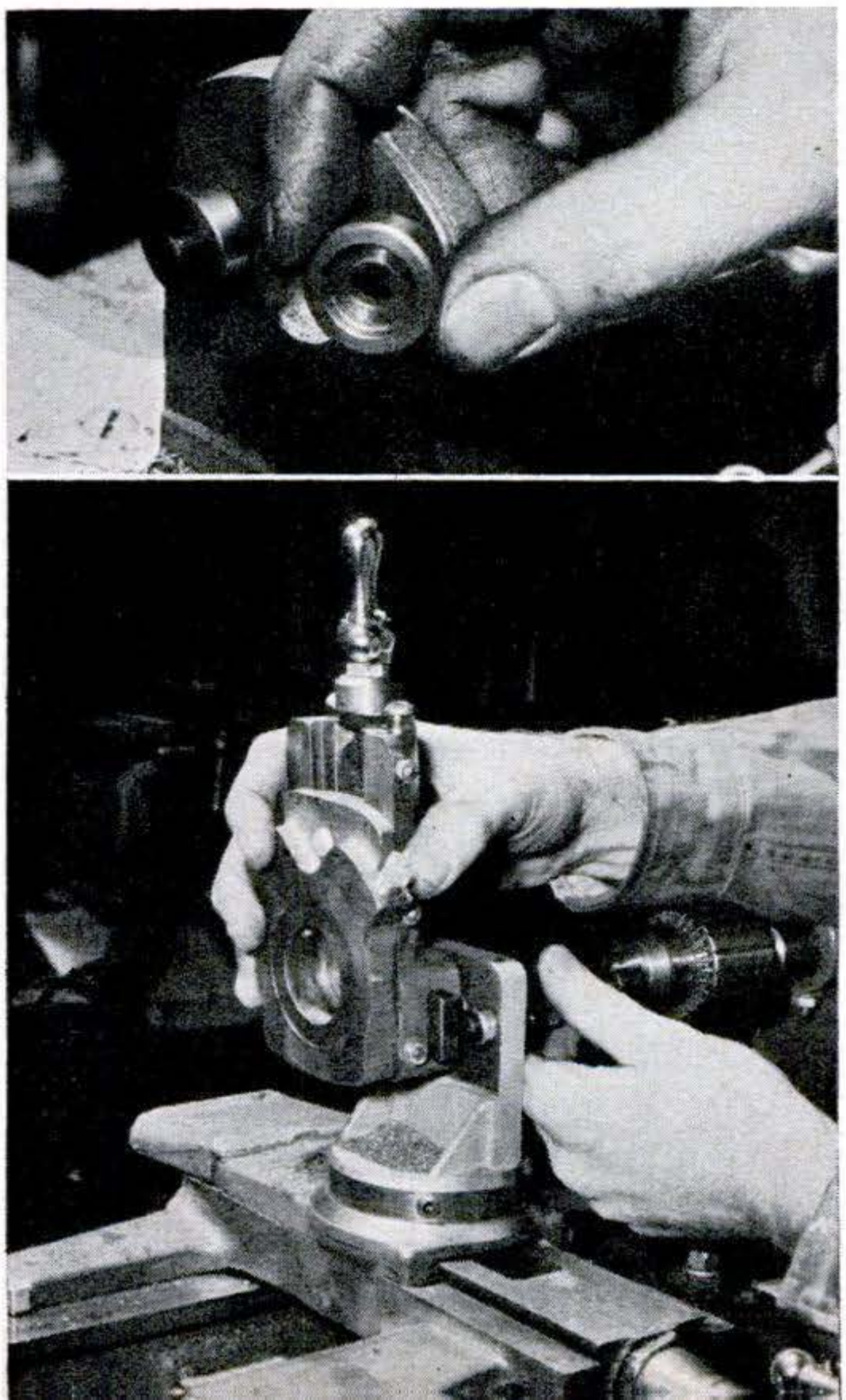


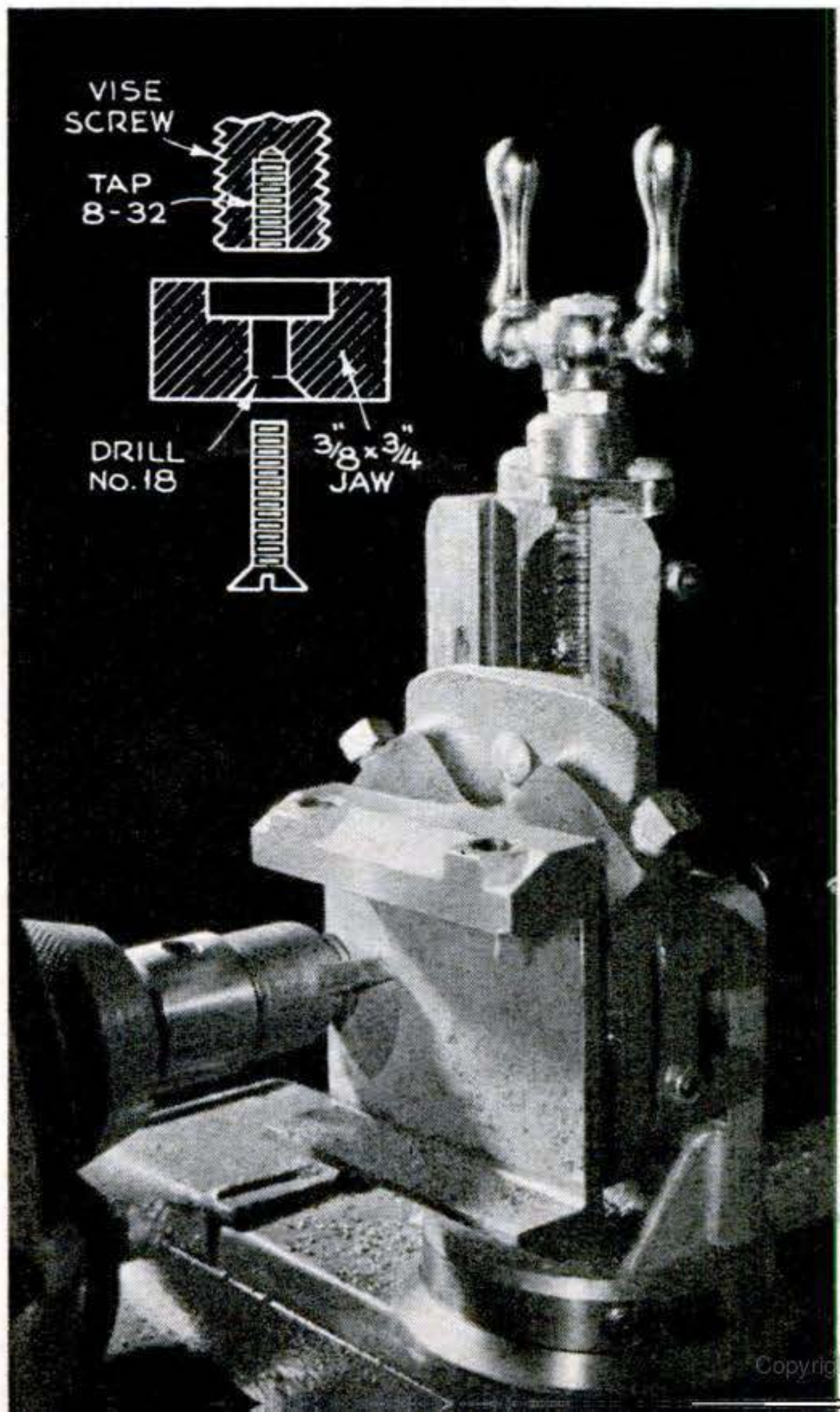


MOUNT THE BASE on the cross slide with locking pins and screws, web side toward the spindle and square to the ways. Chisel a mark at zero and any other graduations wanted. Set a fly cutter to swing just above the webs. Face by advancing the cross feed (left above). With a big drill or a fly cutter, make a hole to fit the lathe tool post in the center of the faced side. Then drill a No. 7 hole ⅜" from each edge as at right above and tap ¼"-20.

TURN TWO BUTTONS from steel rod to just enter the narrow part of the compound slot. Drill them ¼" and recess for the screws that hold them on the faced upright, as below. Slip the tool post through the large center hole from the headstock side. Then slide the compound slot over the buttons and the foot of the post as in the bottom photo. Tighten the tool post against a tool holder slipped into its slot on the right-hand side.

MOUNT THE VISE on the compound rest, its jaw horizontal. With a milling or a fly cutter, face the inside as shown below, using slow speed and feed. A straight milling cutter is good for machining the lower jaw. To attach a movable jaw to the vise screws (handier than a loose piece) grind the screw ends flat to get under casehardening. Then drill and tap them 8-32. Drill, counterbore and countersink the jaw piece as shown. END





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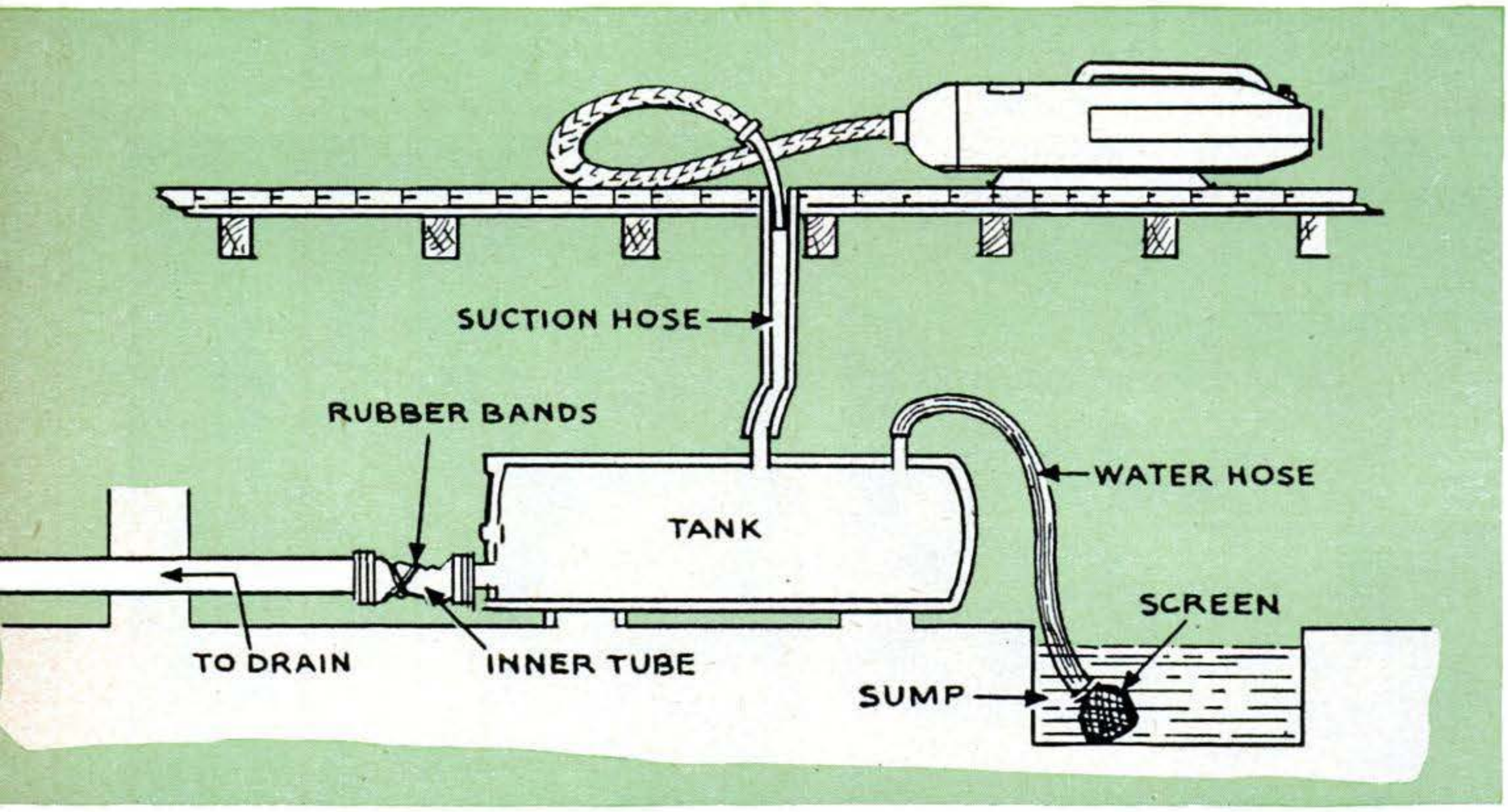
Two Ways to Pump Water with a Vacuum Cleaner

For a quickly rigged emergency pump, Frederick H. Martens of Plainfield, Ill., suggests using a vacuum cleaner and a spouted kerosene container or five-gallon can.

Jam the vacuum-cleaner hose over the spout or filler neck and seal it with tape. Push a piece of garden hose well down into the tank through the other opening (make a second one if necessary) and seal it also. Check the level in the can often. Empty it when water comes near the top.

J. P. LaPoint of Buckroe Beach, Va., uses a vacuum cleaner to drain a furnace sump. An old hot-water tank was laid flat on the ground and hoses were run from two upper openings, one to the sump, a larger one up through the floor to the cleaner. At the bottom of the tank there is an improvised check valve—a piece of inner tube pinched together lightly by rubber bands.

With the cleaner on, suction collapses the inner tube so that no air can enter; water is drawn from the sump. With the cleaner off, the valve opens and water drains out.



Lock Guards Lawn Mower

Youngsters won't be able to move your lawn mower if you lock it (left). A bicycle lock placed over the bar and one blade will prevent cut fingers and ruined flower beds. *—W. H. McClay, Pasadena, Calif.*

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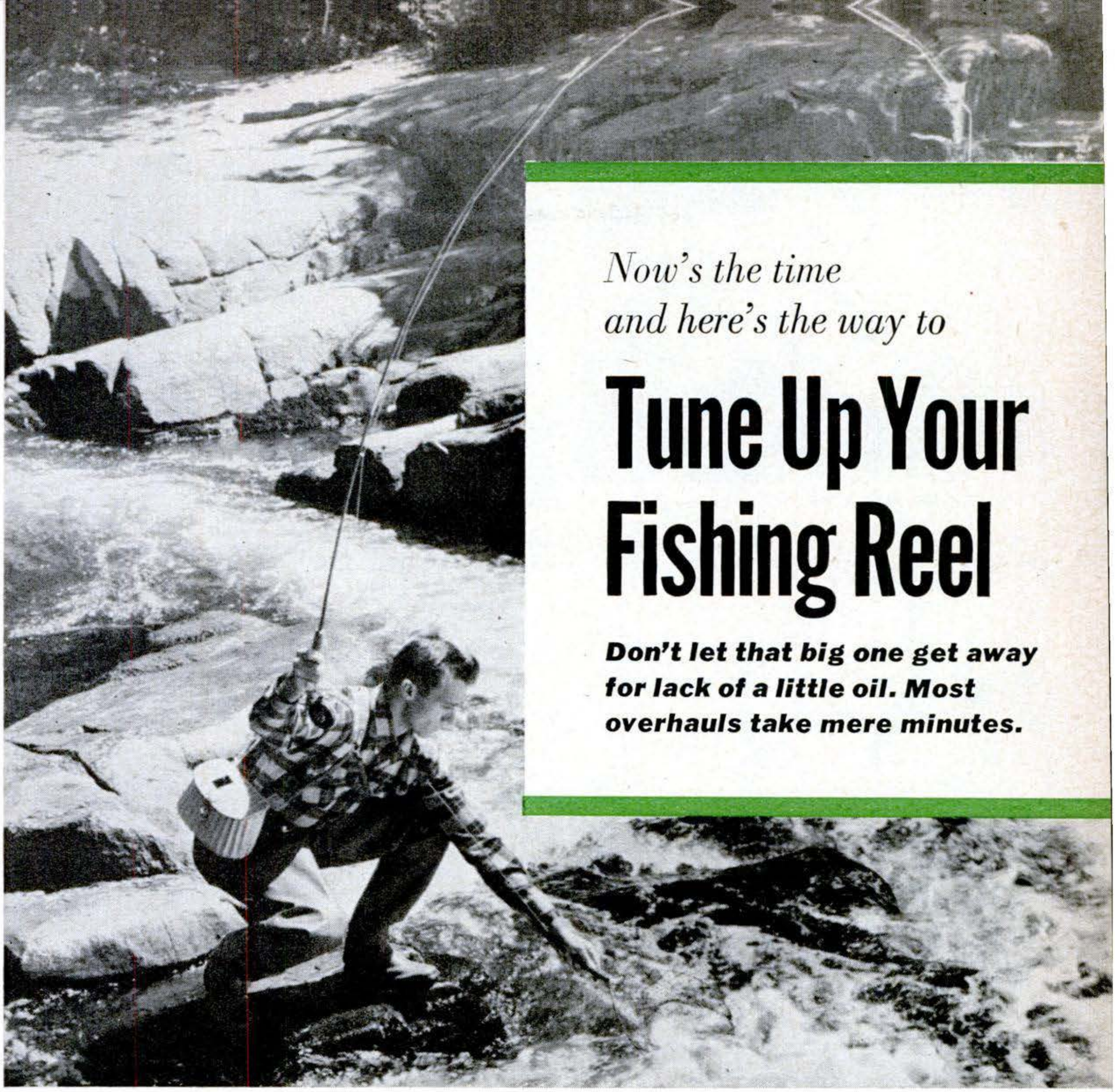

Now's the time and here's the way to

Tune Up Your Fishing Reel

Don't let that big one get away for lack of a little oil. Most overhauls take mere minutes.

By Jack Wilson

I KNOW. You're dreaming of those long, looping casts into the lily pads when the mist rolls off the lake like balls of cotton and the predawn chill makes you glad you put that extra sweater on.

Well, if you want to make those dreams come true, now's the time to take an early-season look at the fine, precision piece of machinery that's going to do most of the work—your reel. Gritty, grime-gummed gears, sluggish after the long winter lay-off, aren't going to get your line off the ground, and a faulty friction drag will net you only a nasty backlash. A spring tune-up now will unlimber your reel and keep it humming happily all summer long.

Types of reels. Most common of the three basic reels is the level-wind bait-casting rig, used for bass, pike, pickerel and other fresh-water fish. Its critical parts, the spool and worm-driven line shuttle, put out an astonishing number of r.p.m. on a fast, hard cast and must free-wheel smoothly if you're after real distance. The fly-casting trout reel, not shown here, is essentially just a spool for line storage and is thus easily serviced. For cleaning and lubrication, follow the general rules for other reels.

The star-drag salt-water reel, which can

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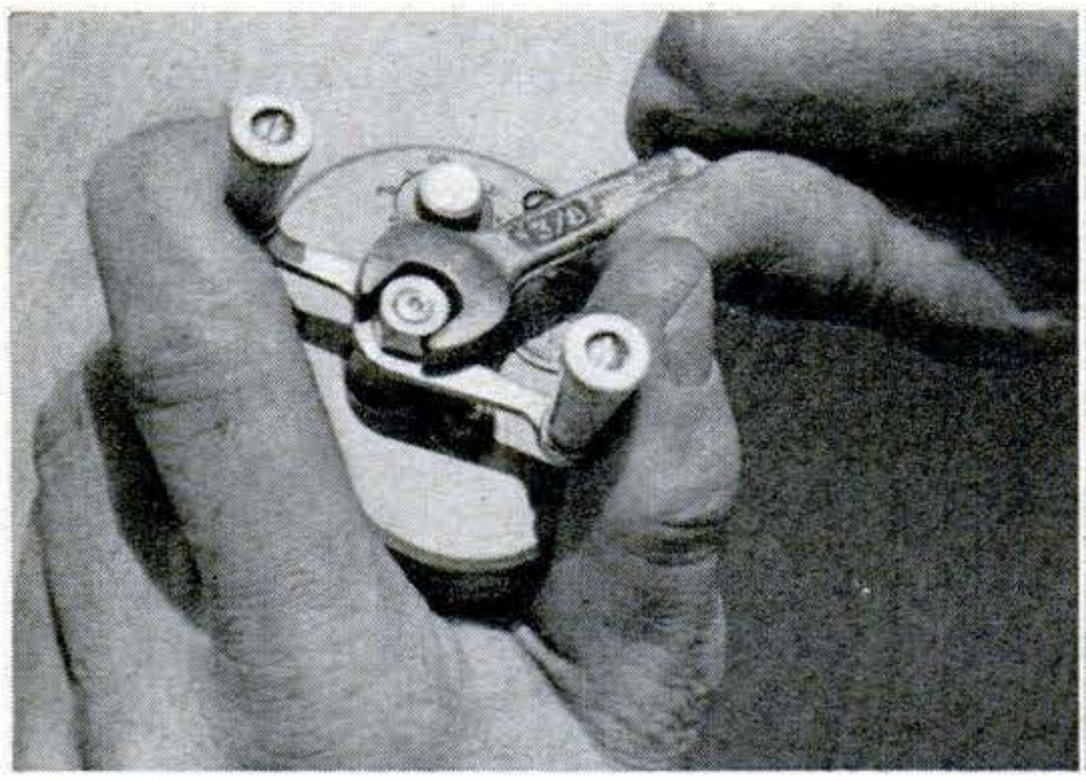
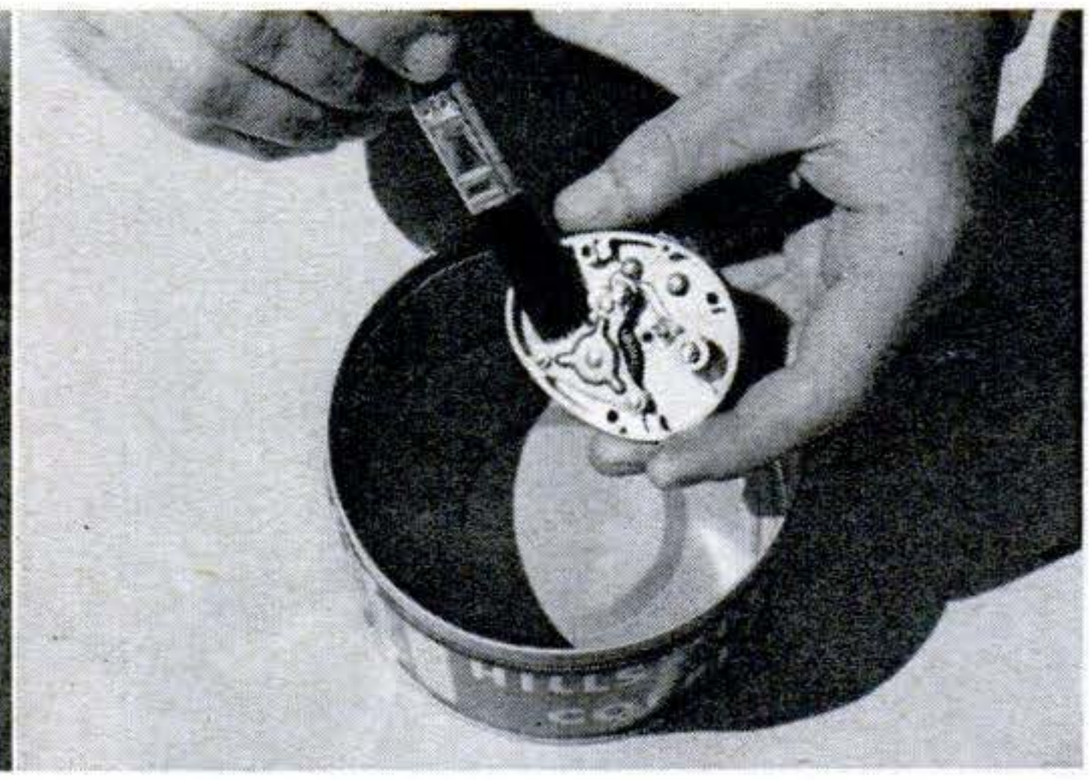
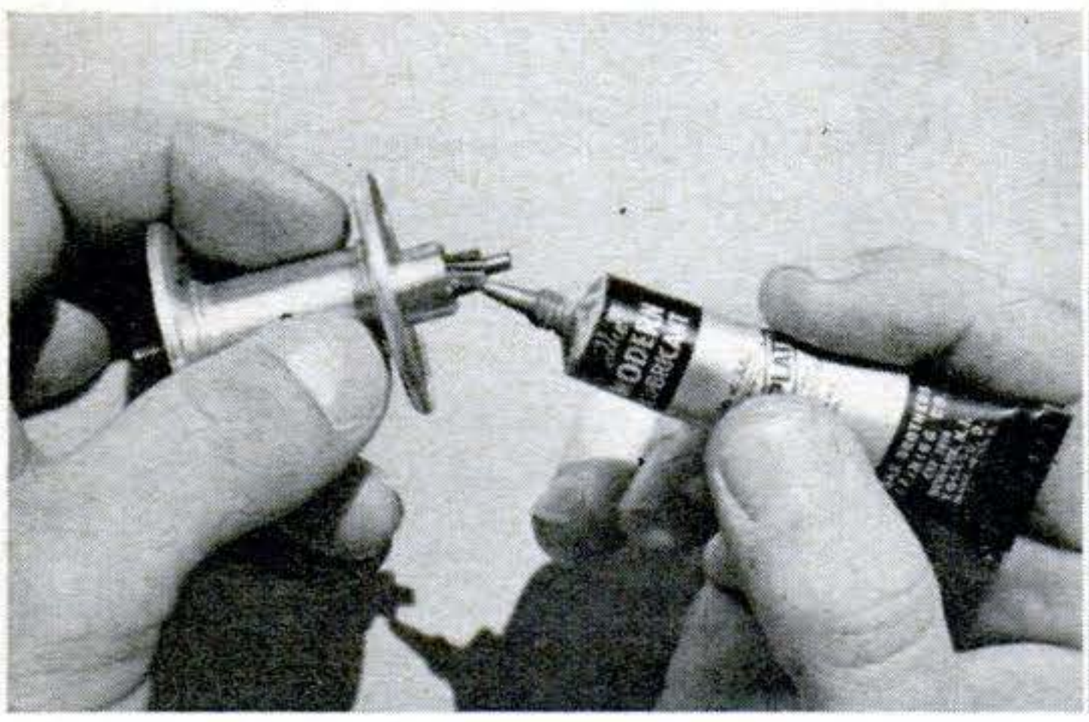
How to Care For Your Level-Wind Bait-Casting Reel



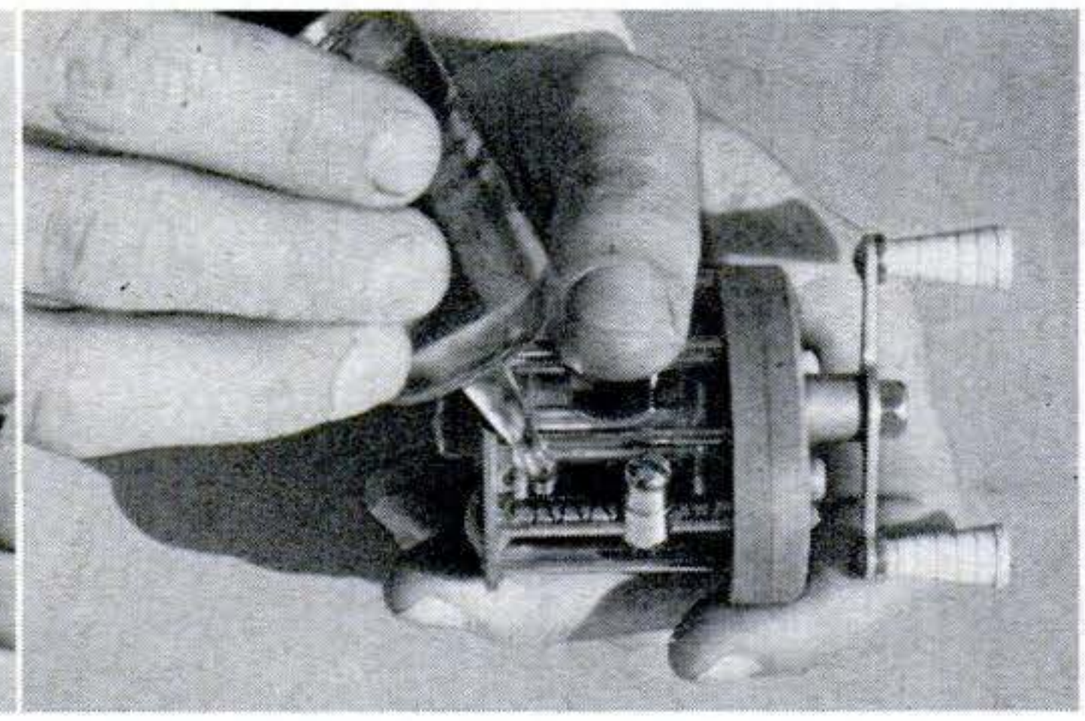
START TAKING REEL APART by unbolting crank handle. Removing screws around edge of reel will then release right-hand side plate and line spool. Leave left-hand plate intact.



RIGHT-HAND SIDE PLATE, which contains main parts, is scrubbed with household cleaning solvent and brush to get in cracks. Stop here unless inner parts need replacement.



GEARS, such as this spool pinion, should be packed with grease, not oiled. When all parts have been put in shape, reassemble reel and spin it several times to work in lubrication.



LUBRICATE REEL before and after every outing as well as at seasonal overhauls. Oil worm gear from underside of reel (above), and fill oil holes at main bearings on side plate.

hurl a lead lure the length of a football field out over rolling surf, is a delicate, high-strung bundle of gears, springs, pawls and ratchets. Approach it with awe, reverence and two strong hands ready to catch any small, wayward parts. You can breathe easier with a spinning reel, newest comer to the sport, which is a sweet performer in either fresh or salt water and needs care at only a few points.

Lubrication. The general rule here is grease on gears, oil on bearings. Two exceptions are the level-wind worm, which should get oil although it is a gear, and the handle-knob post, which should get grease although it is a bearing.

Special reel greases and sperm-base oils are available at tackle stores and should be used in place of ordinary household lubricants, which offer too much friction and will not stand up as well under the deteriorating action of water, rust and corrosion.

Tackling the hard parts. Unless you have an awfully good memory, putting together some of the more complicated reels such as the star drag may seem like a puzzle with too many pieces. If a diagram came with your reel, study it carefully to make sure you know what each part is and where it goes. If not, you can use the find-your-way-out-of-a-maze-with-a-ball-of-string method, listing and numbering the parts as you take them out. Reassembly of the reel will then be a simple matter of putting back the parts in reverse order.

If you don't want to go all the way, you can stop at one of the main subassembly divisions, as shown in the photos, and turn the rest of the job over to your tackle store's reel repairman. In any case, your reel should get a complete tear-down and overhaul at least once a year.

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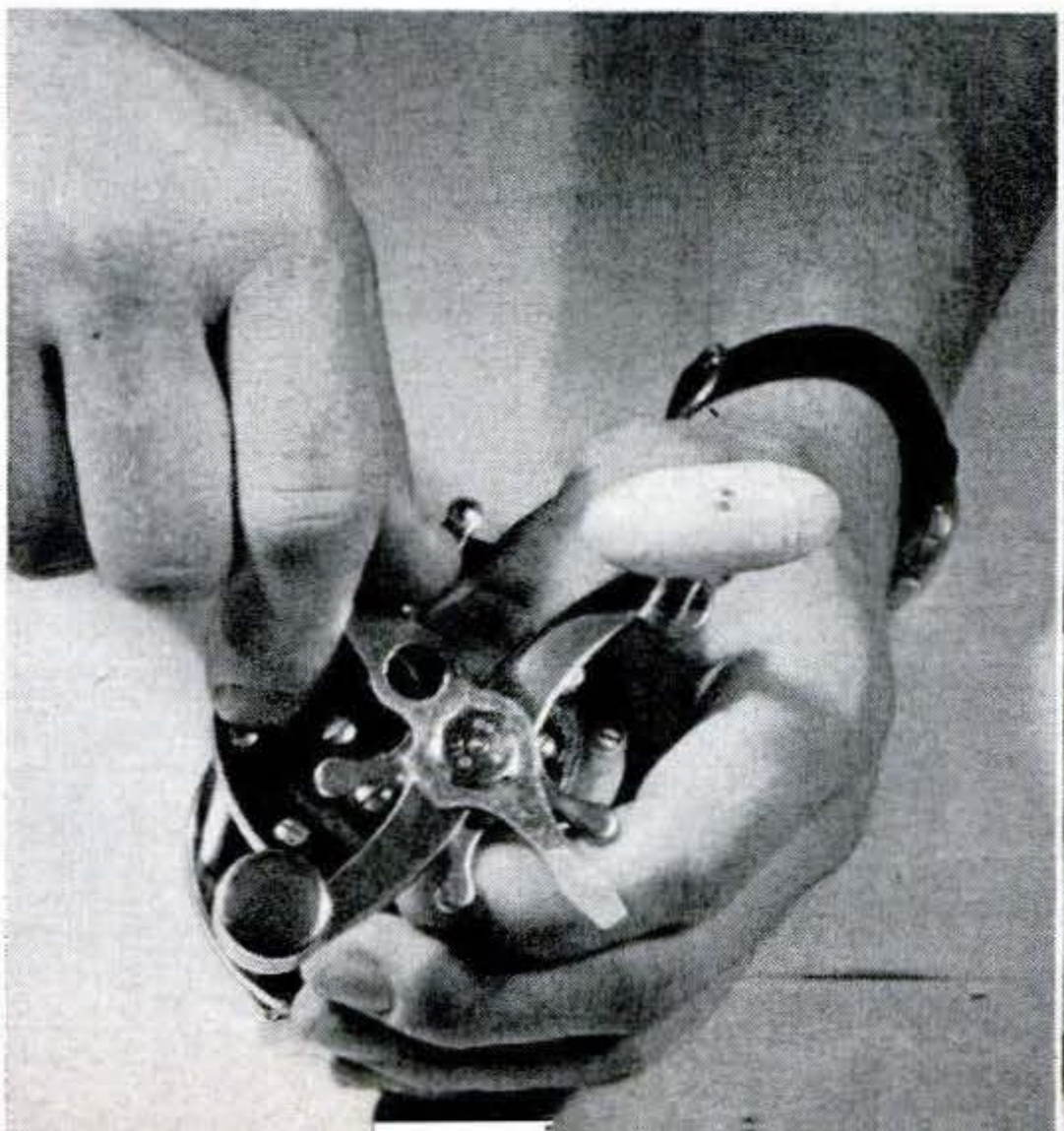
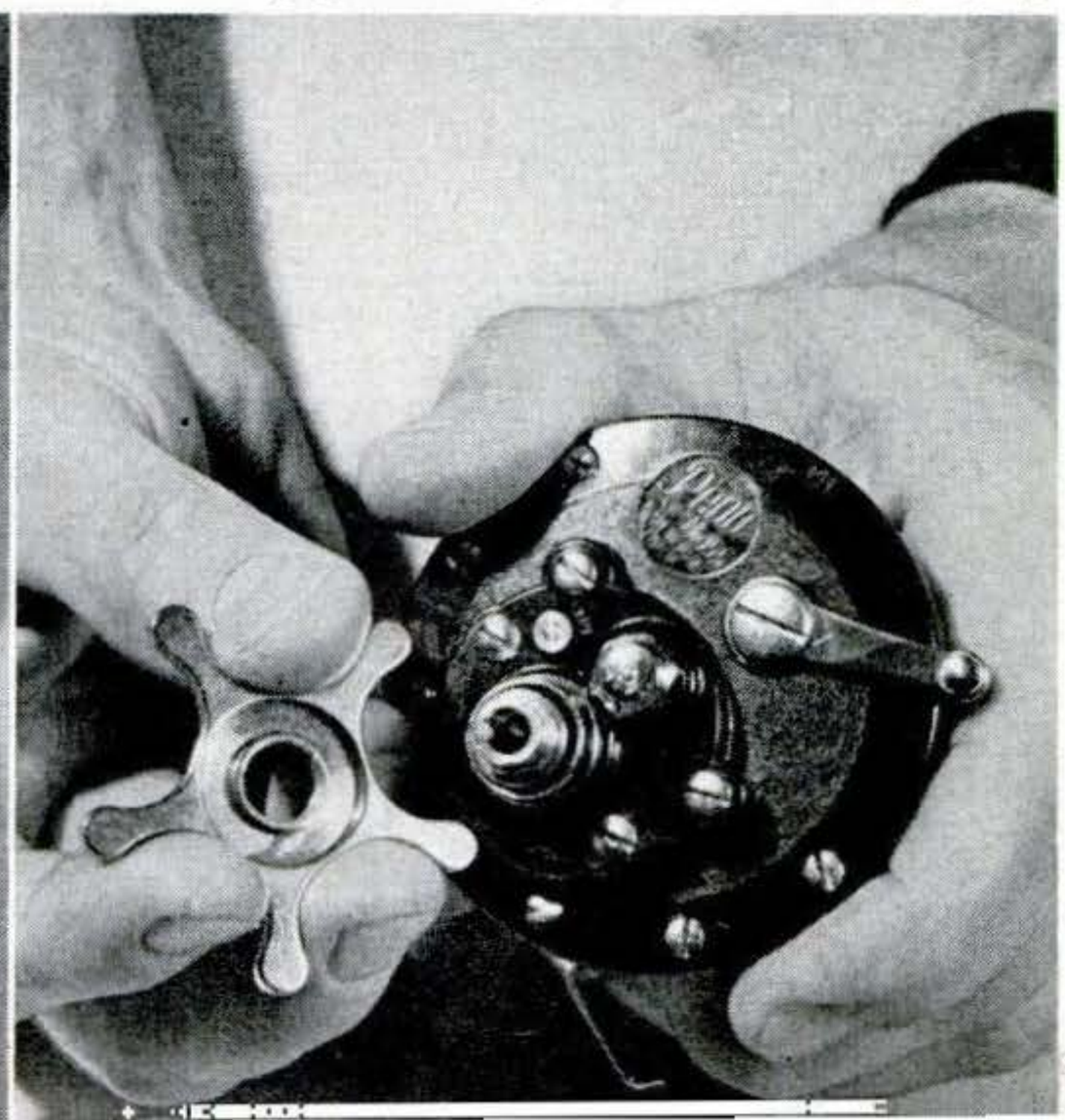
Star-Drag Salt-Water Reels Need Extra-Careful Handling

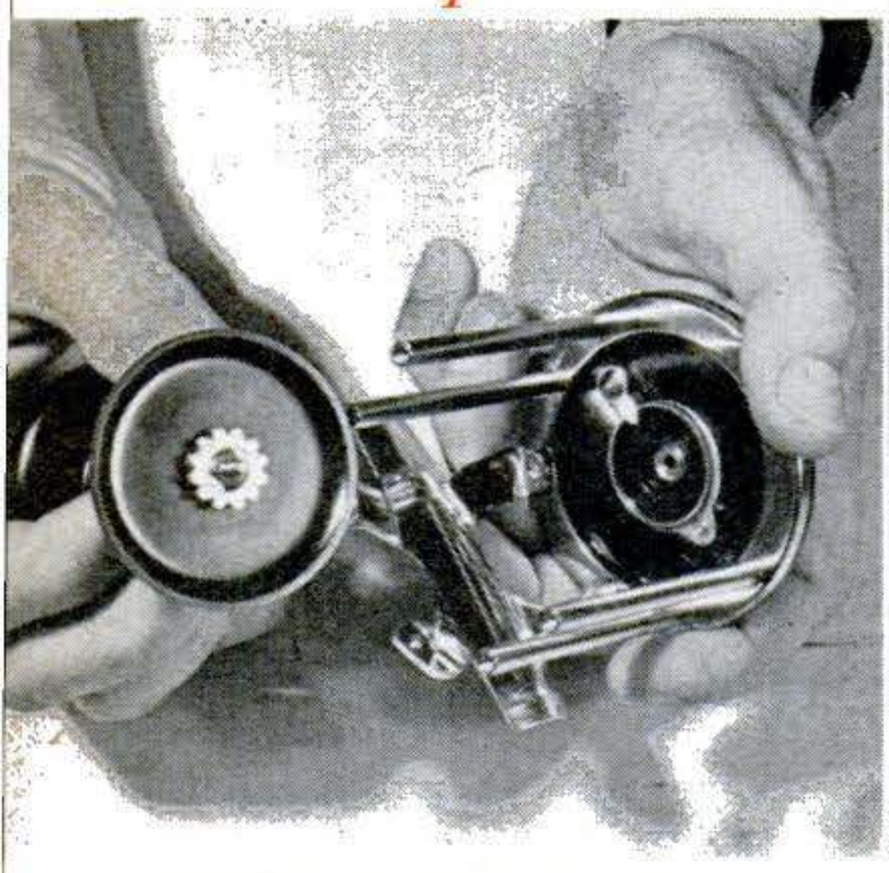
SPECIAL WRENCH has sockets that fit bolts on reel. Start disassembly by removing lock screw on crank; then unbolt crank as shown. File down screwdriver tip if it's too blunt.

DRAG STAR is unscrewed next. Nipple in center of side plate is oil hole for right-hand end bearing; the one to left above it is for the driving gear. *(Please turn the page.)*

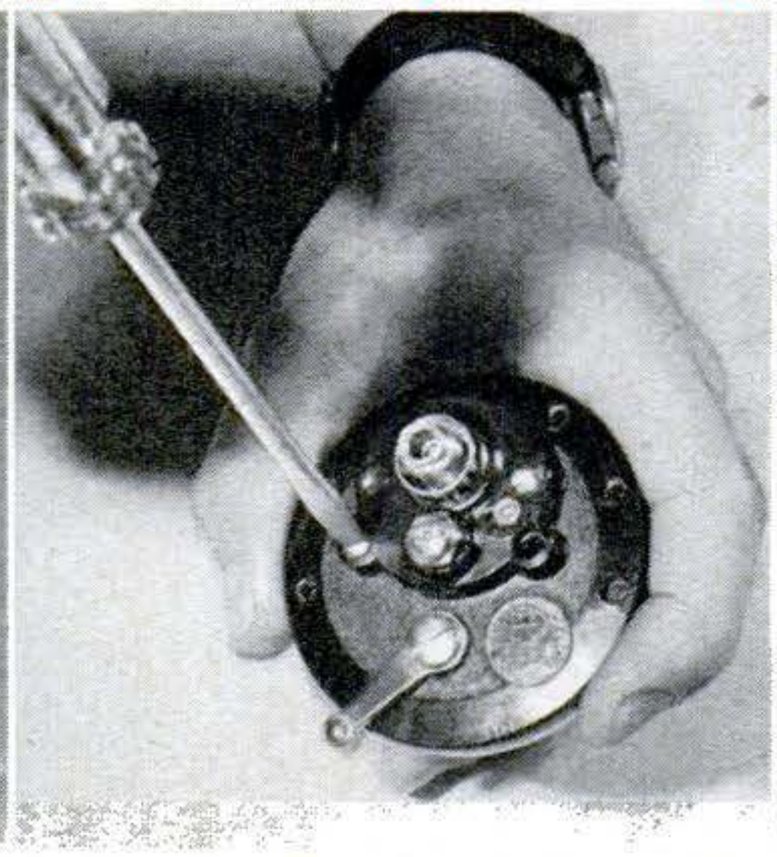




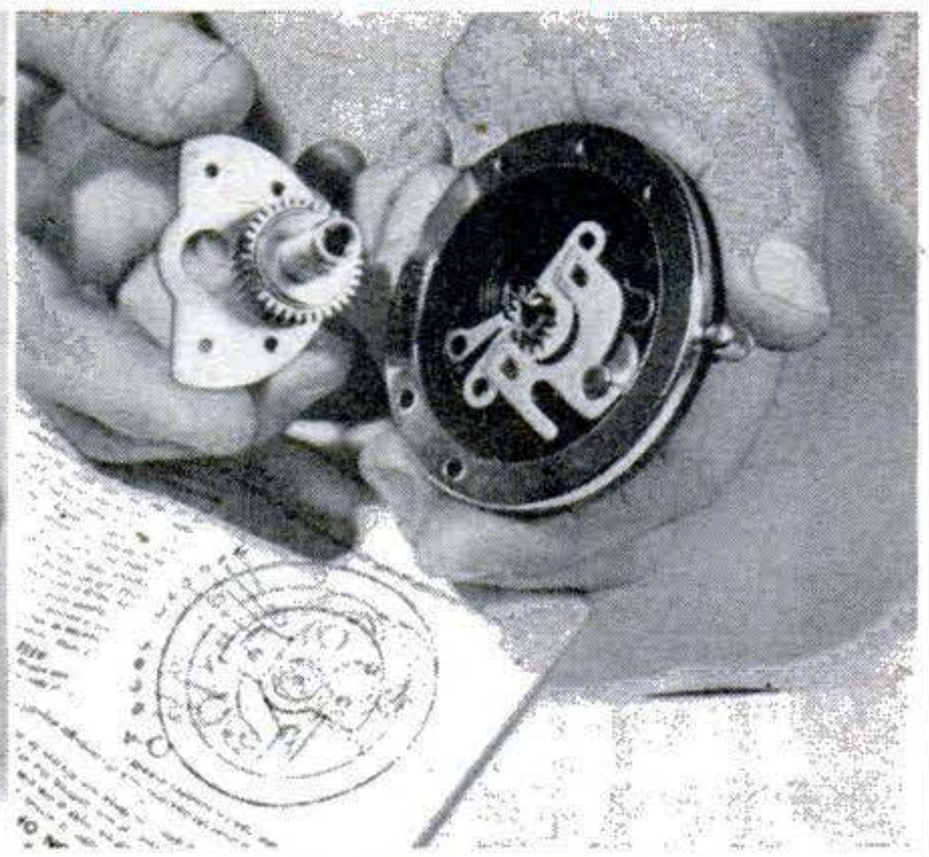
More Tips on Putting Your Surf-Casting Rig in Top Shape



REMOVE SCREWS at edge to release right-hand side plate and spool. Flush parts with solvent, then reoil gear, click tongue and spring. For temporary overhaul, stop here.

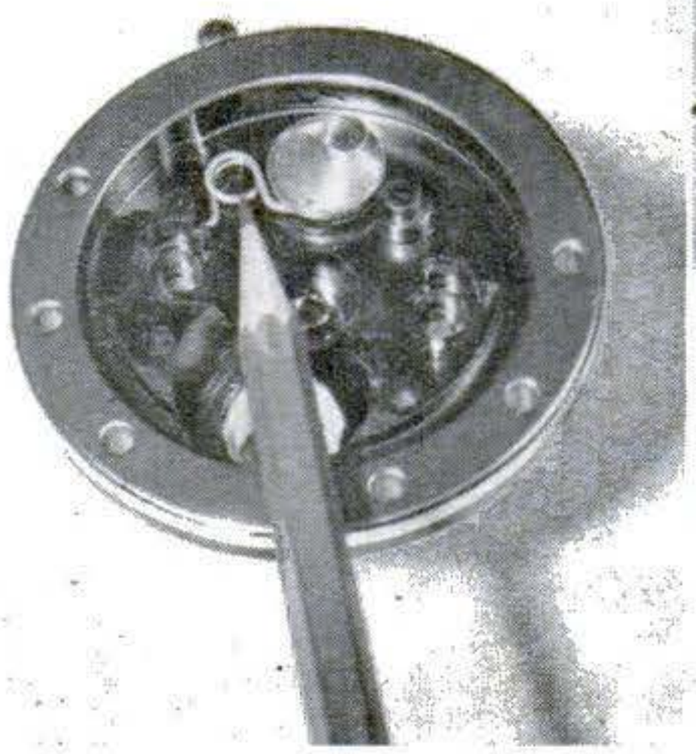


NOW IT GETS TOUGH. To reach inner works, remove four remaining screws in right-hand side plate. Be sure to hold assembly where you won't lose small parts that may drop out.

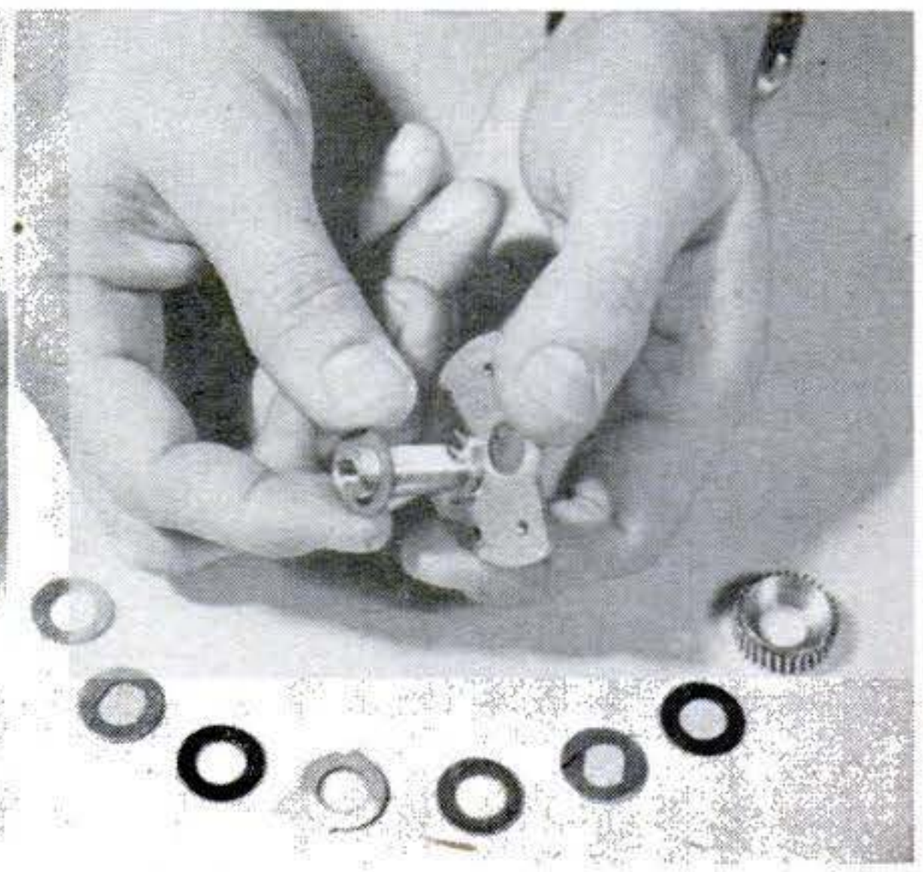


GEAR BRIDGE lifts out when screws are removed, exposing clutch mechanism. Tip plate over in palm, and pinion gear, dog spring and dog will drop out. Clean these and regrease.

TO REMOVE PINION YOKE, push it down with left thumb and slide eccentric jack to the right to free it. Yoke will then lift—or pop—out, along with two clutch springs.



ECCENTRIC SPRING (pencil point) is hard to take out, harder to put back. Better leave it in place unless either it or eccentric needs replacement. Clean and oil.

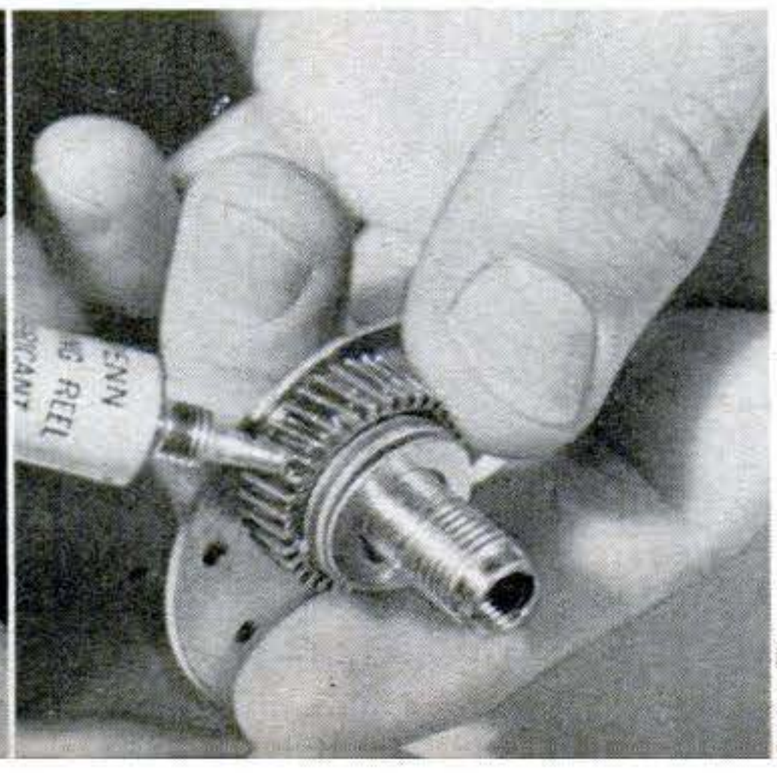


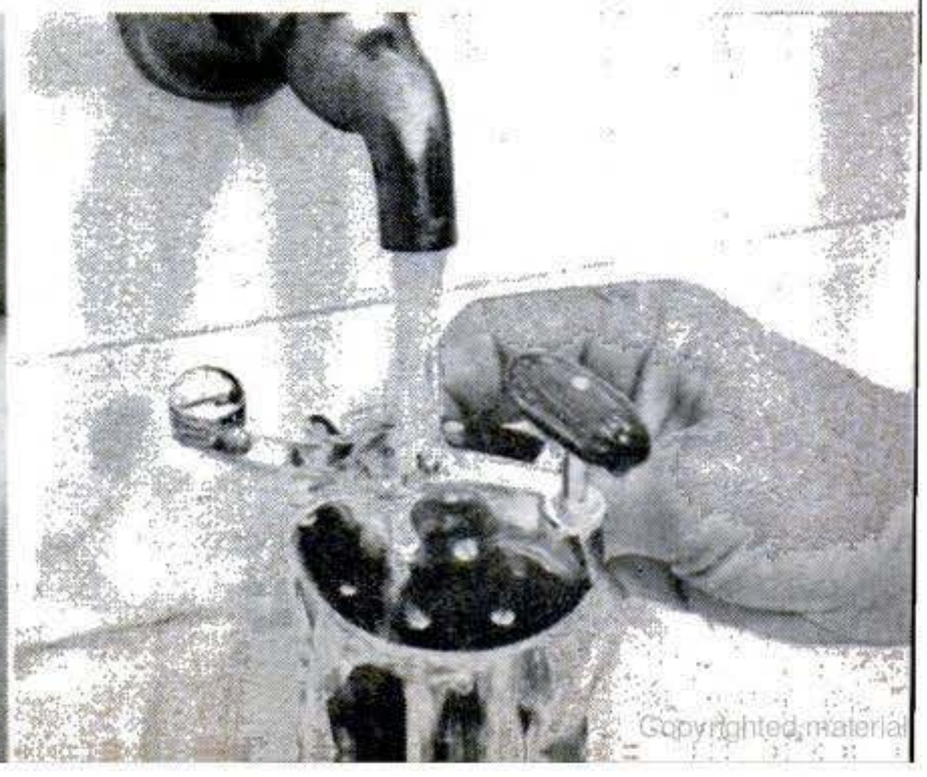
DRAG DISKS are metal and leather washers. Keep all parts dry and replace leather disks that have become oily or brittle. If spring washer (left) has flattened, rebow it.

RATCHET BUSHING (right) will stick to steel post (left) if rust forms. Tap out lock pin, soak joint in penetrating oil, then clean post with steel wool and coat with grease.

GREASE DRIVE GEAR after assembling star drag, taking care not to get any on disks. Also grease clutch springs and spool pinion gear. Reassemble reel, crank several times.

AT END OF EACH DAY'S fishing, wash out salt water with warm fresh water, then dry reel and lubricate oil holes at bearings. Wipe metal parts with soft oily cloth to protect finish.





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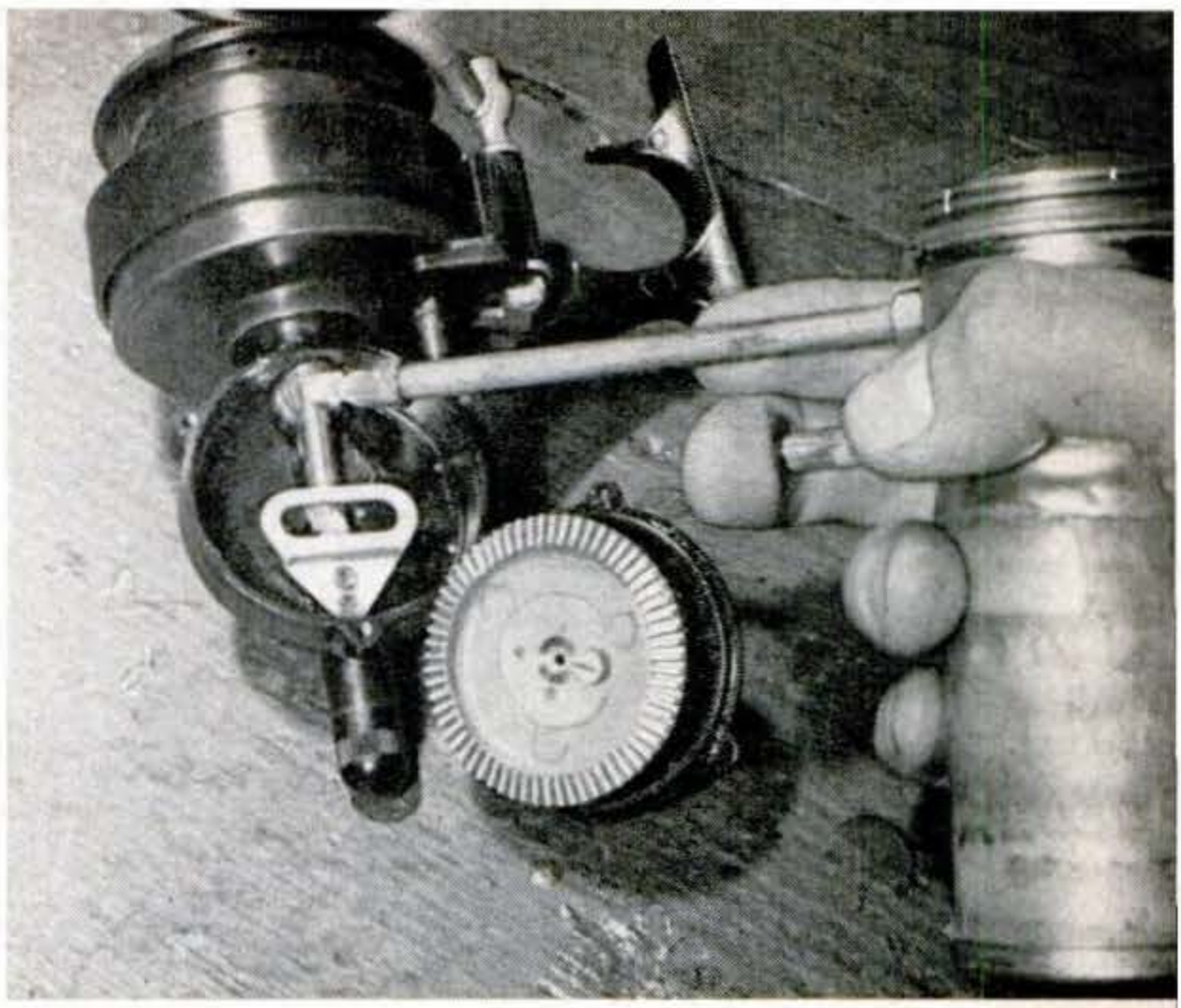
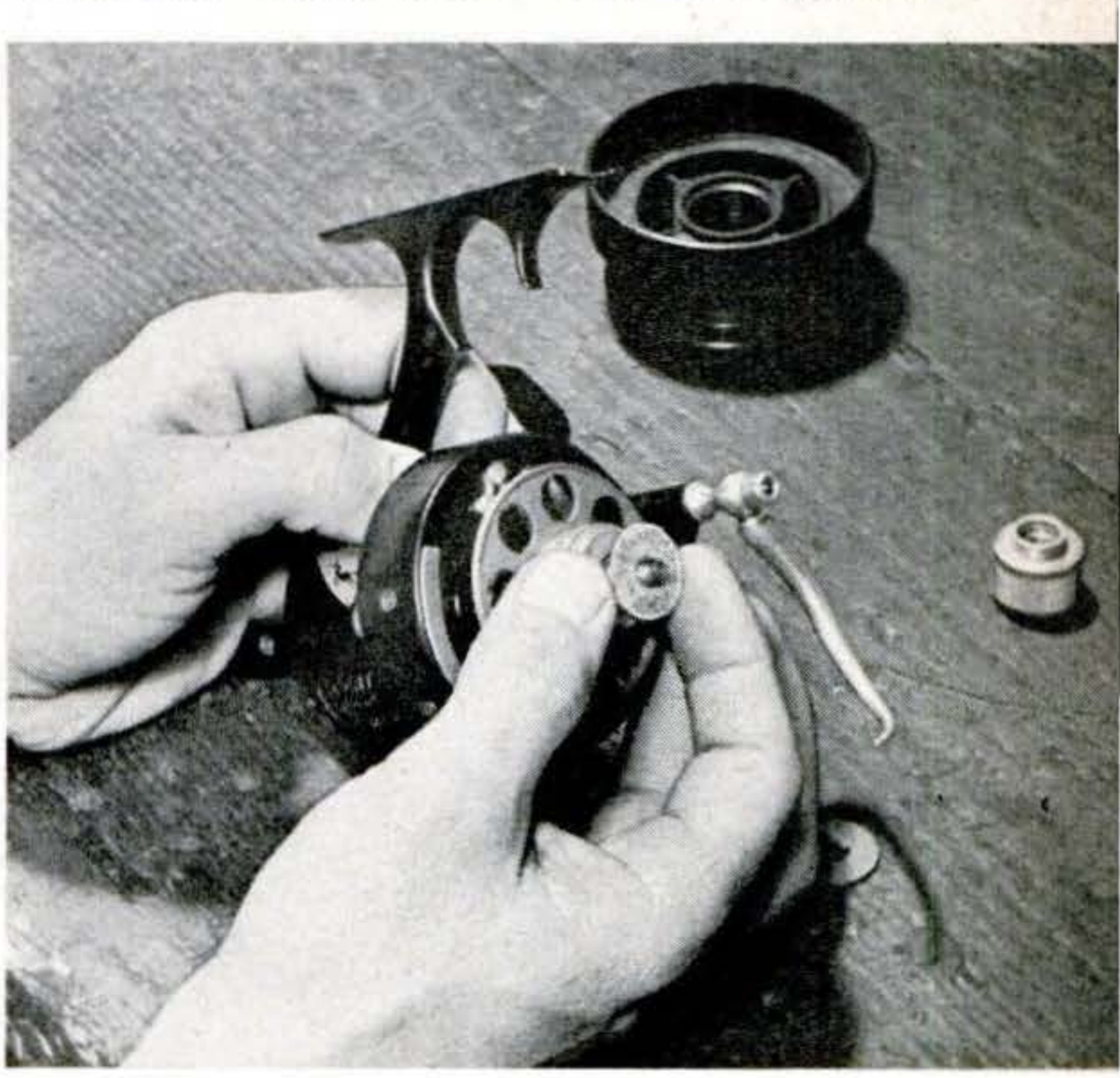
Making Your Spinning Reel as Good as New Is a Lead-Pipe Cinch

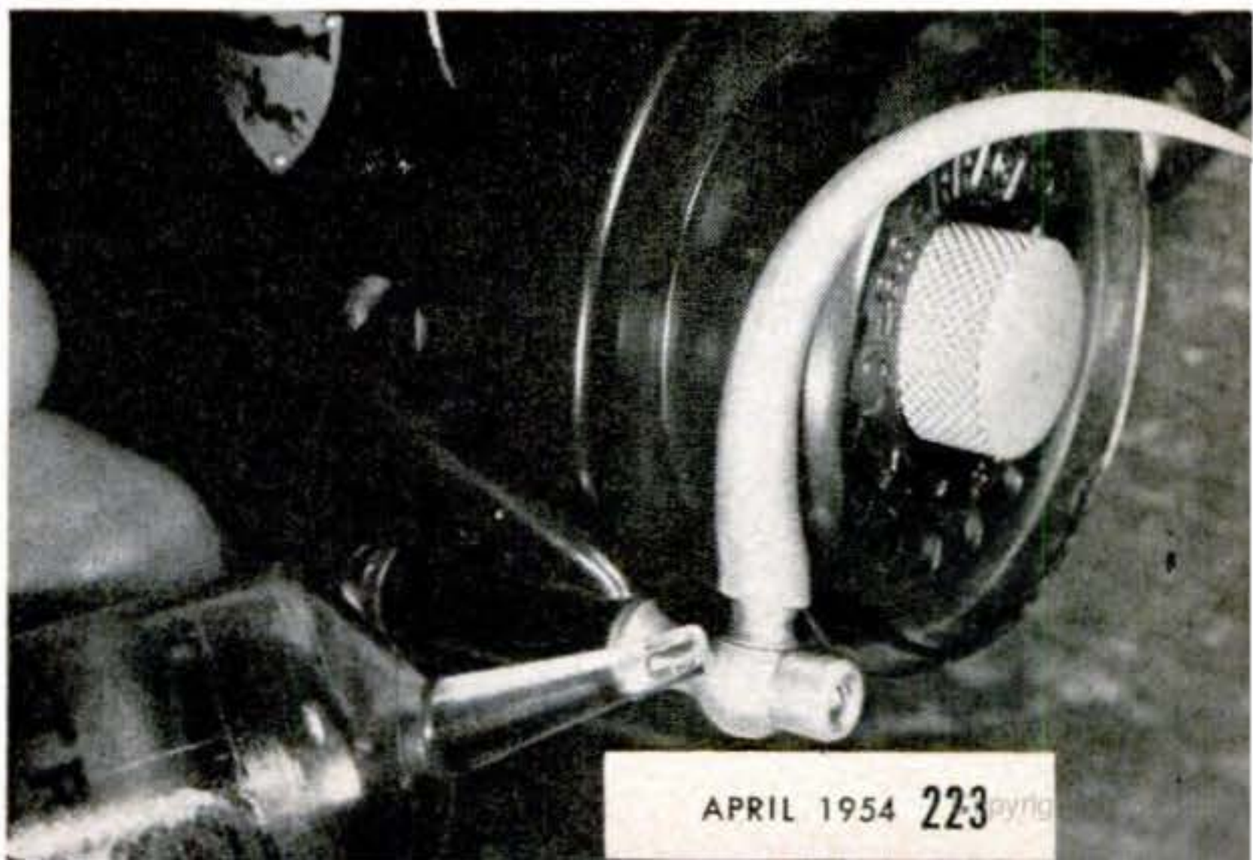


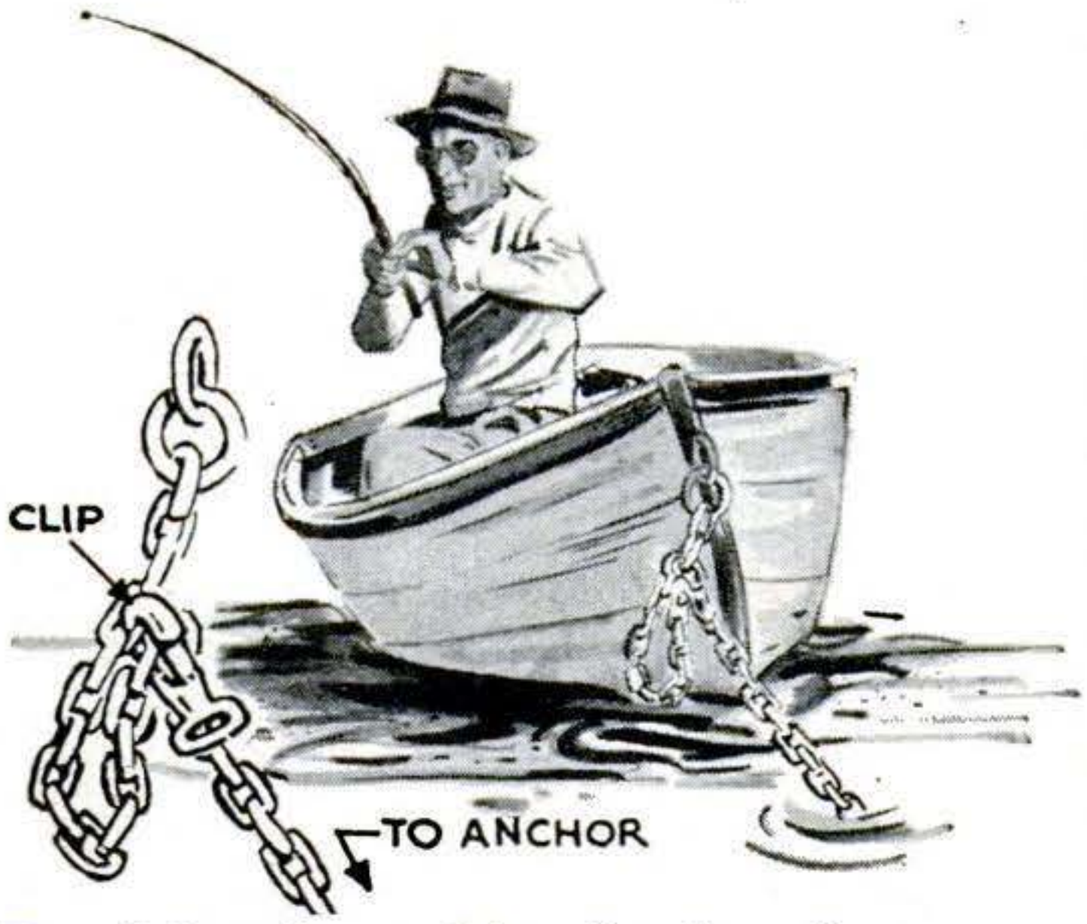
SPINNING REEL is easily disassembled by removing screws that hold side cover plate. Grease pinion gear (above), then replace cover and crank reel to distribute grease.



DRAG FELT must be kept dry and free from oil or spool will stick. Check it periodically by removing knurled nut and spool from shaft. Replace felt when it becomes worn or oily.

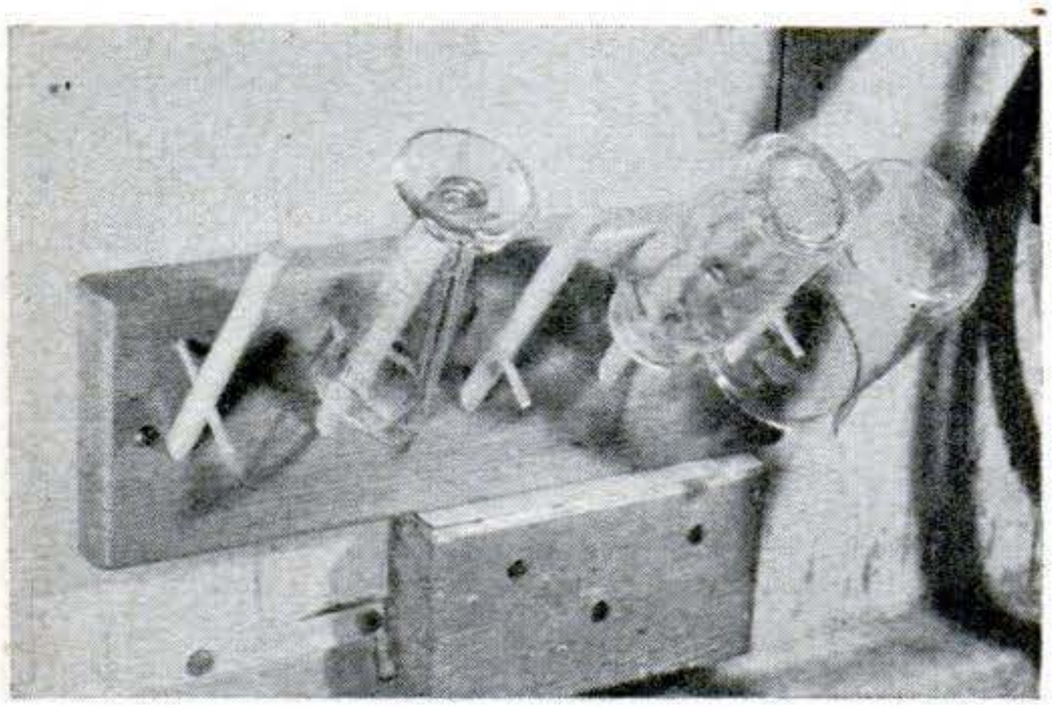
TINY ROLLER BEARING that carries line on the reel-in must be oiled every time reel is used or it may freeze, causing line to cut grooves in its surface. **END**





Boat Anchored by Spring Snap

WHEN going fishing, I carry a spring snap in my tackle box. If the boat I rent has an overlong anchor chain and no hook on which to take up the slack, I use the spring snap to shorten the effective length of the chain and keep the boat from drifting back and forth over my lines.—*Thomas P. Ramirez, Fond du Lac, Wis.*

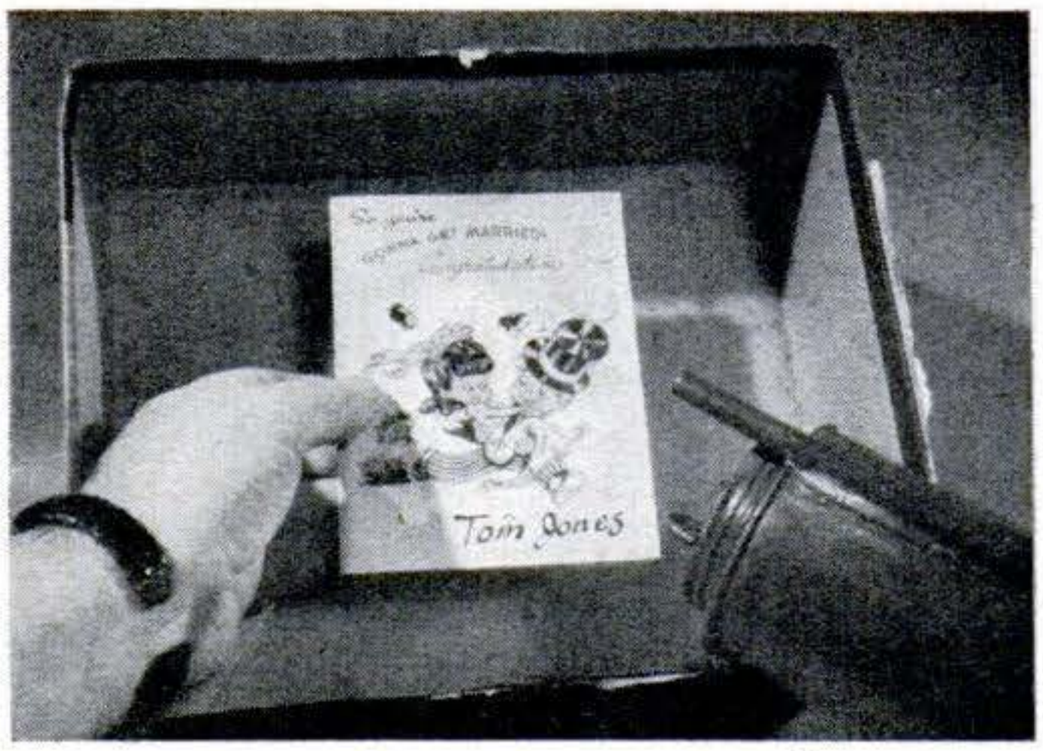


Dowel-Rack Drains Glassware

NO BLUEPRINTS are needed to build this easy-to-make rack on which to hang bottles, jars and other glass containers to drain. The small pegs passing through the bigger dowels not only help anchor the dowels but support the edges of the glassware. The installation shown is in a darkroom.—*Walter E. Burton, Akron, Ohio.*

Sawdust and Cement Make Inlay

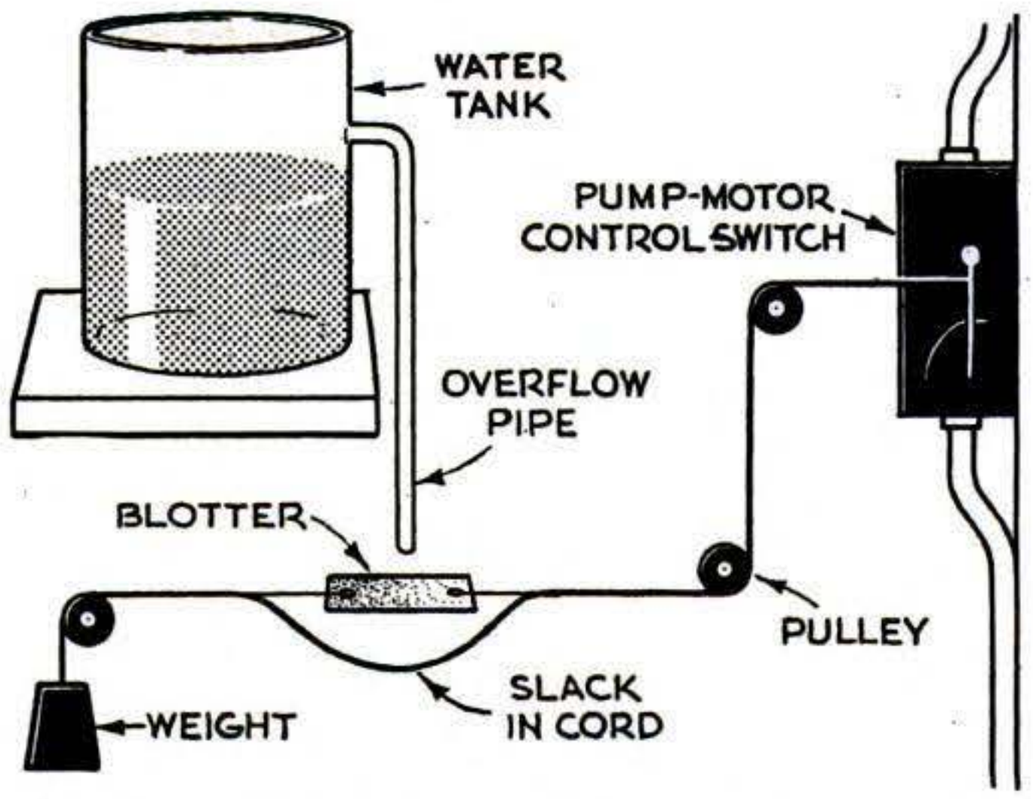
INSTEAD of using bits of wood for small inlay work, try mixing sawdust of a contrasting color with cellulose cement for filling in the inlay grooves. Mix on a piece of glass (wood will absorb the cement) and apply with a putty knife. When dry and sanded smooth, it will look like a perfect inlay.—*Lee C. Stanley, San Diego, Calif.*



Sign Your Name in 3-D Color

FOR a personal touch on greeting cards, write your name with flock—a velour-like coating of finely cut rayon, wool or cotton fibers that stands out about 1/16″ when applied to a tacky surface.

To get the tacky surface, make an adhesive ink by diluting liquid glue with enough liquid food color to make it flow readily from a broad lettering pen. Now write your name on the card with the special ink and apply the flock. A gun, as shown in the photo, is best, but the stuff can be sifted on. Snap the card to remove excess flock and let it dry at least an hour.—*Ken Murray, Colon, Mich.*



Blotter Tears and Stops Water

HERE'S the system I use to shut off the flow to my water tank on those occasions when I can't wait around for it to fill. Water from the overflow tank soaks the blotter, tearing it apart, and the dropping weight jerks the pump switch.

The weight should be just too light to work the switch when hung on it. To set it for action, tie a piece of blotter in place. Brass reinforcing eyes or staples pressed into the blotter keep the string from pulling out.—*George F. Burnley, Oakland, Calif.*

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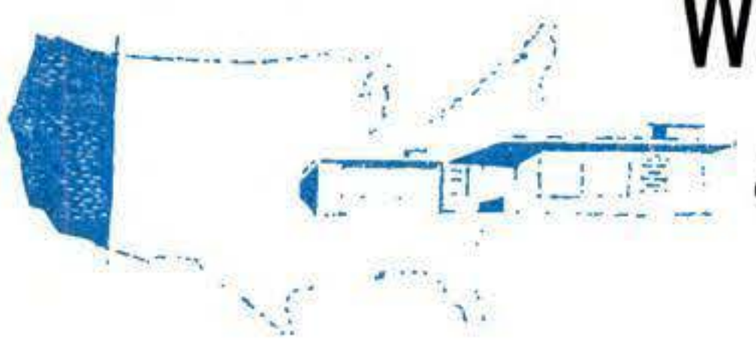


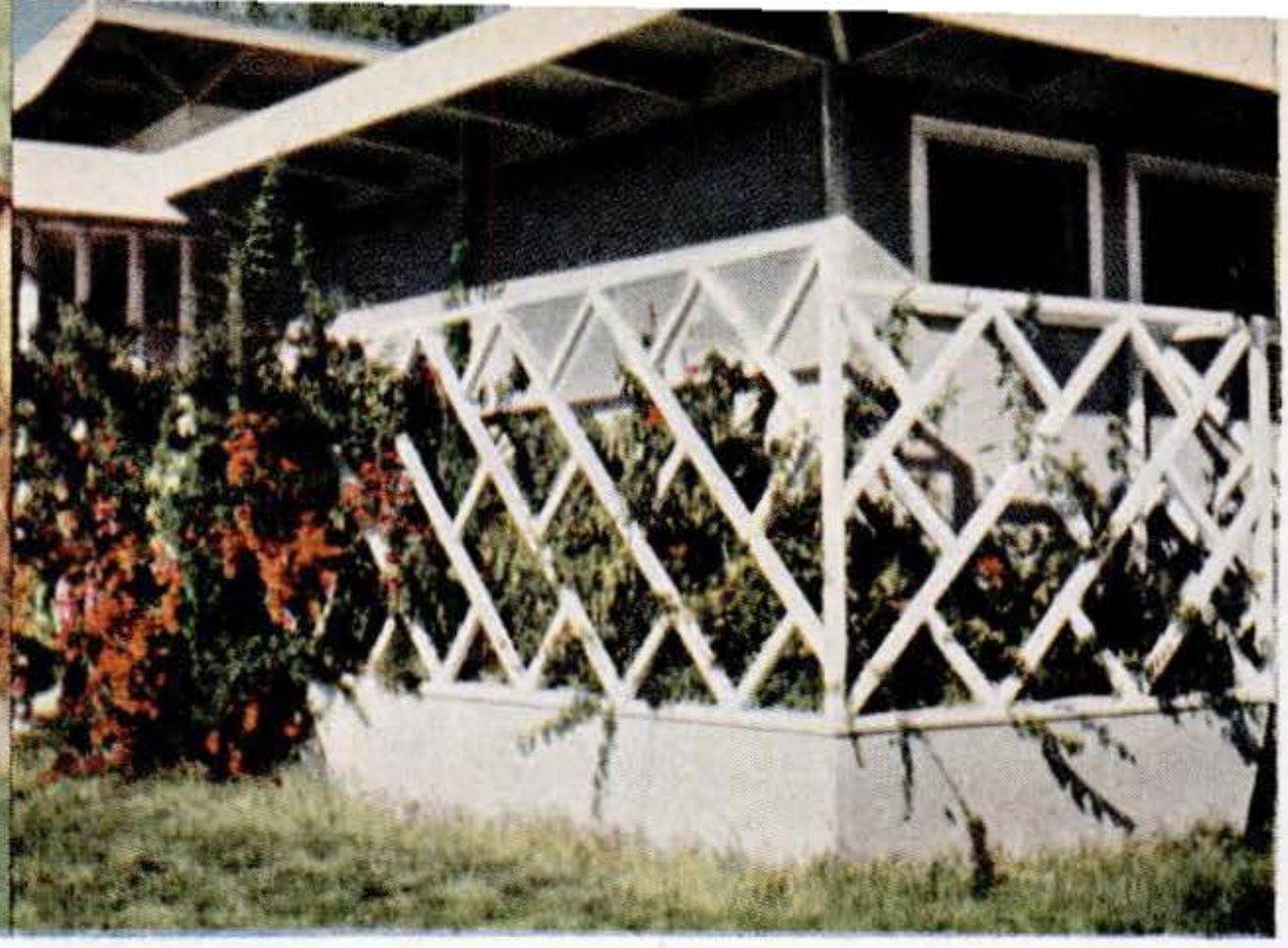
Western Designs Suggest
40 Easy Ways You Can

Improve Your Home and Grounds

In California, which frequently impresses Eastern visitors as a land of fences and patios, many families live outdoors more than is possible in much of America. And there, craftsmen have vied with each other in designing exterior fittings for modest homes that make lawns and patios as inviting as fine living rooms. In this special report, you'll find 40 pictures of various ways in which Californians have dressed up their homes and grounds. Many of these Western ideas are equally applicable to homes in the other 47 states of the U.S.A.

Back-yard possibilities range from this ultimate to a simple fence screen built in a weekend.

Alternate boards admit breeze but stop vision.



High, planted lattice acts as living screen.

Rough-hewn logs make driveway boundary.

Plain rail job supports flowering shrubbery.

Ledge rail breaks height of tall pool fence.

Flowers top painted boards of odd widths.

The Western Way:

Dramatic Fences Serve Many Purposes

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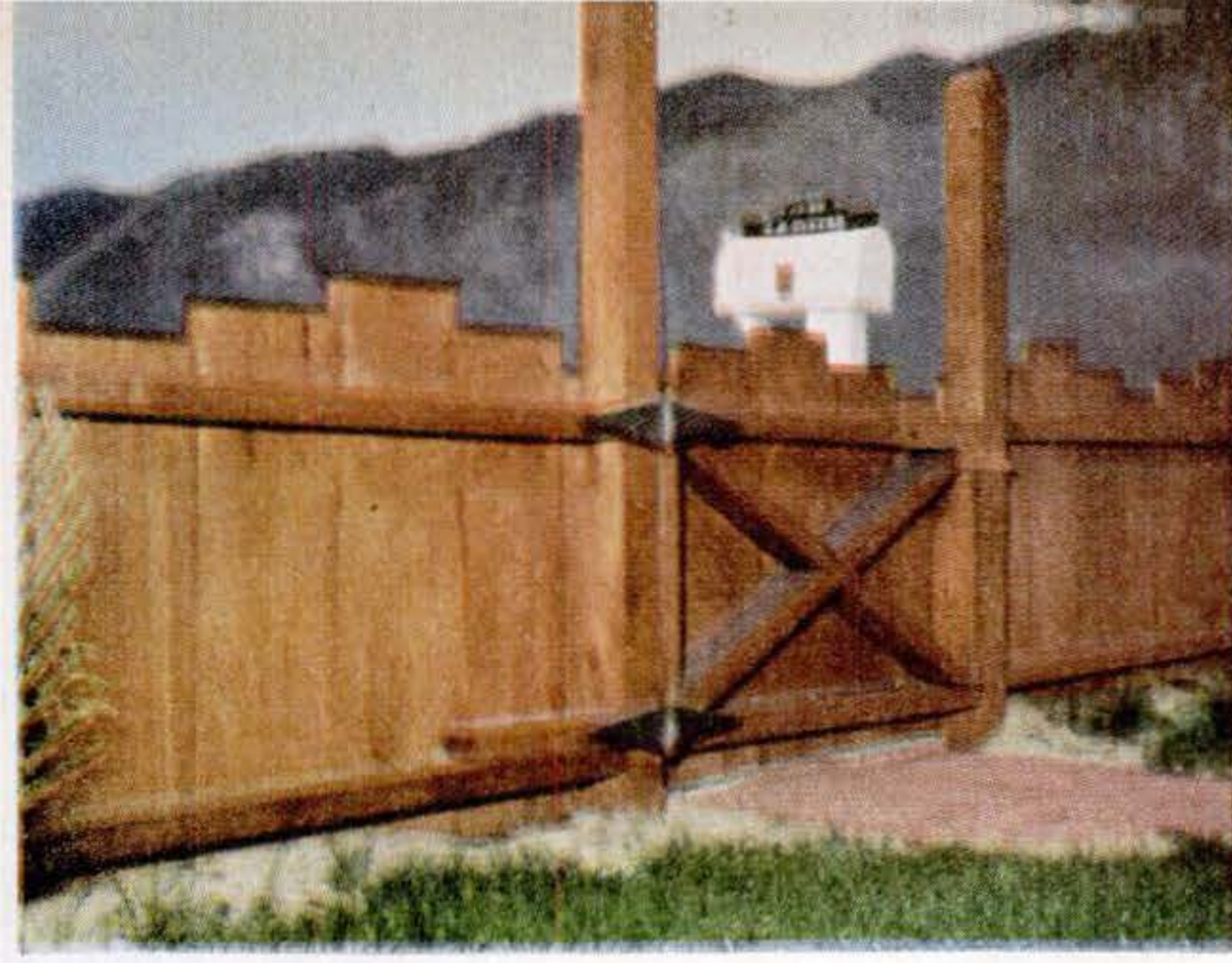
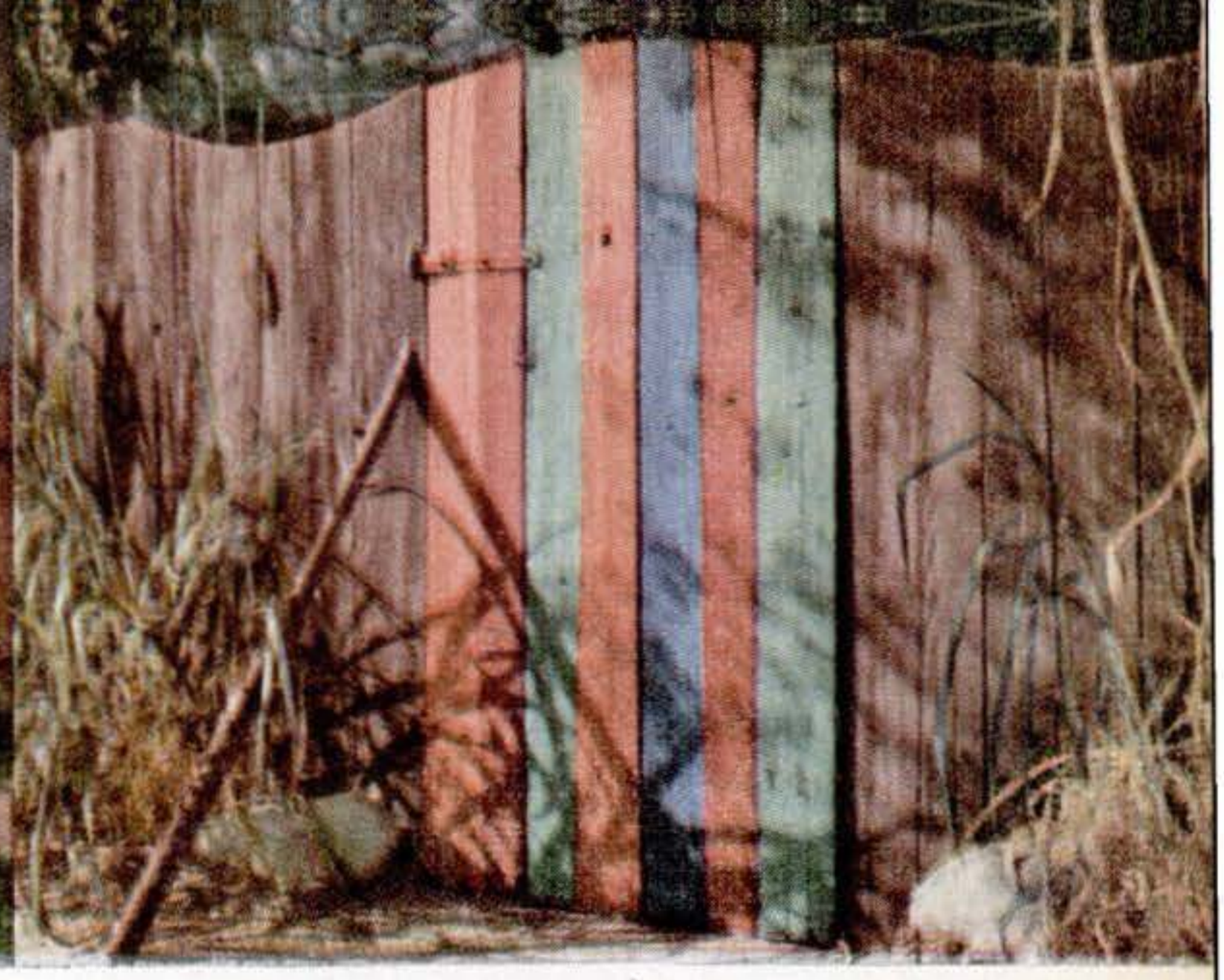
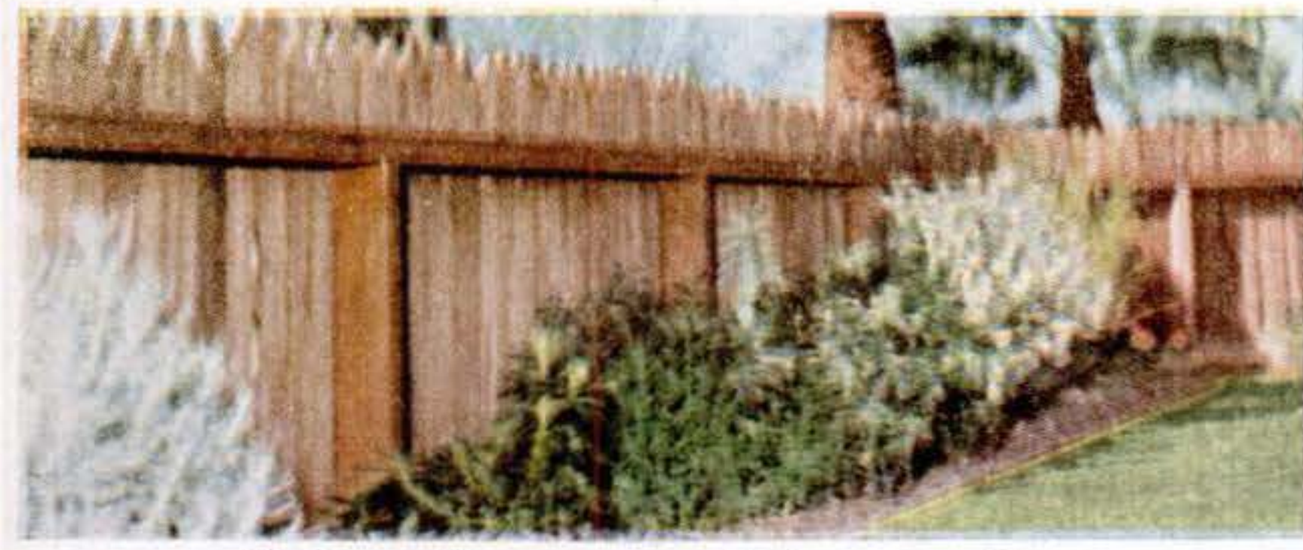


Boards of irregular height avoid monotony.



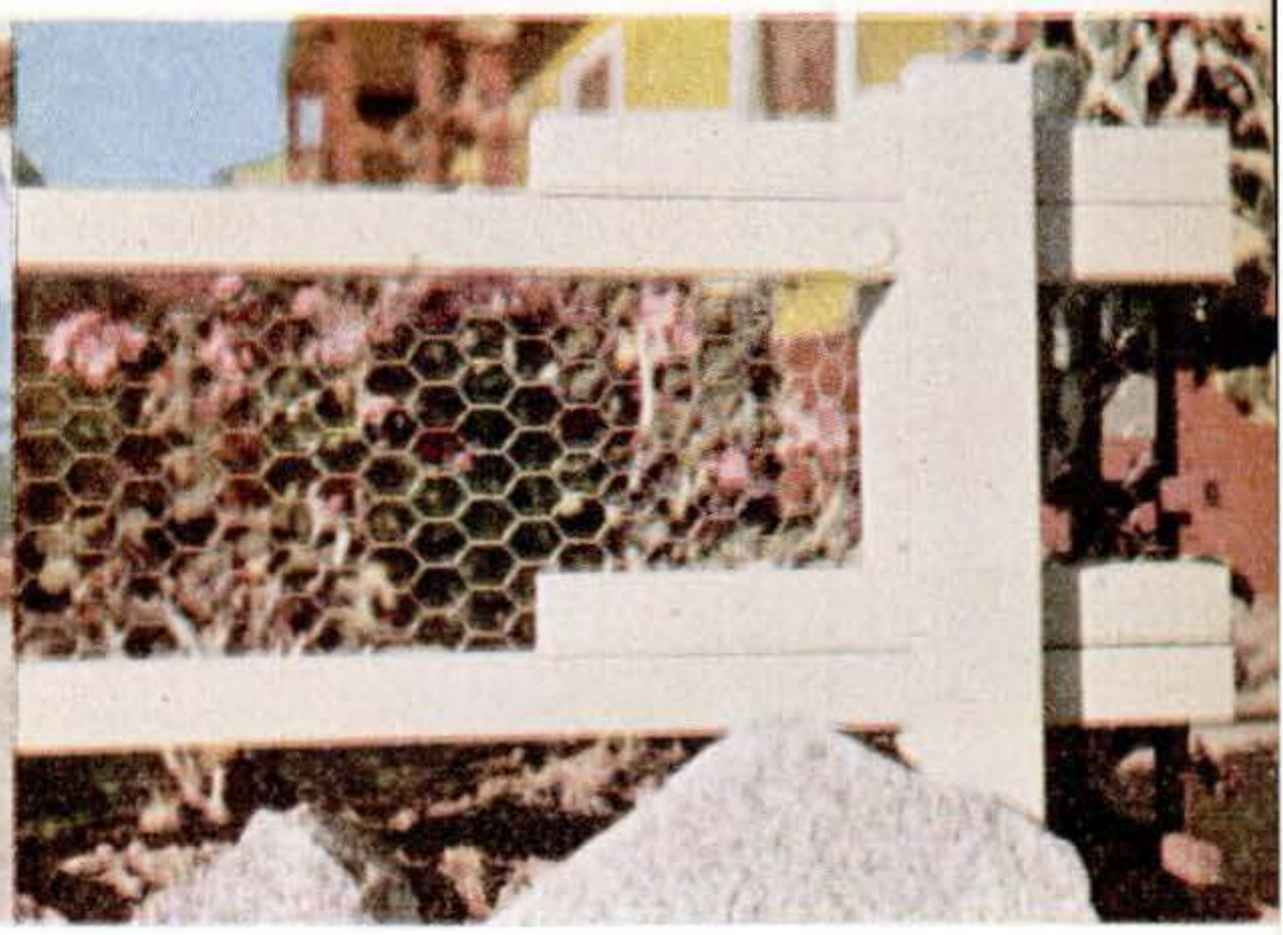
"Joseph's gate" is stained in various colors.



Light palings are nailed to a rail structure.

Classic rail fence has a country-estate look.

Shaggy cedar fence looks well on sandy land.



Chicken wire between rails helps vines start.

IF FENCES just mean pickets to you, better take a tip from your California cousins. Westerners use new and unconventional material for fences. I've seen some that incorporate plywood, plastic, asbestos—even glass and aluminum.

A fence can do more than just memorialize a property line or keep out stray pooches. It can be designed to create just the right kind and amount of privacy. By screening the sun or intercepting the wind, a fence can regulate the weather. It can serve as an outside version of a partition, establishing separate areas of activity. And while it's doing

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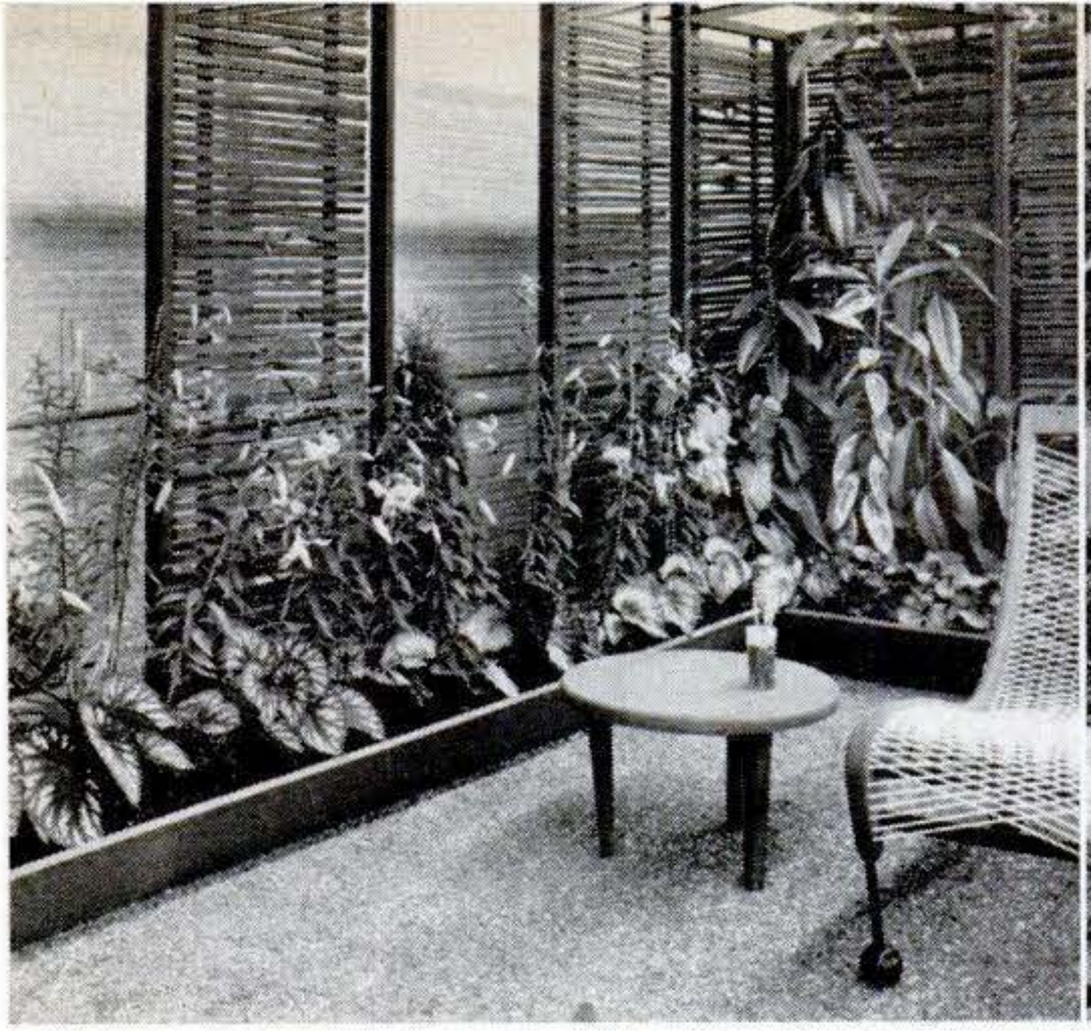
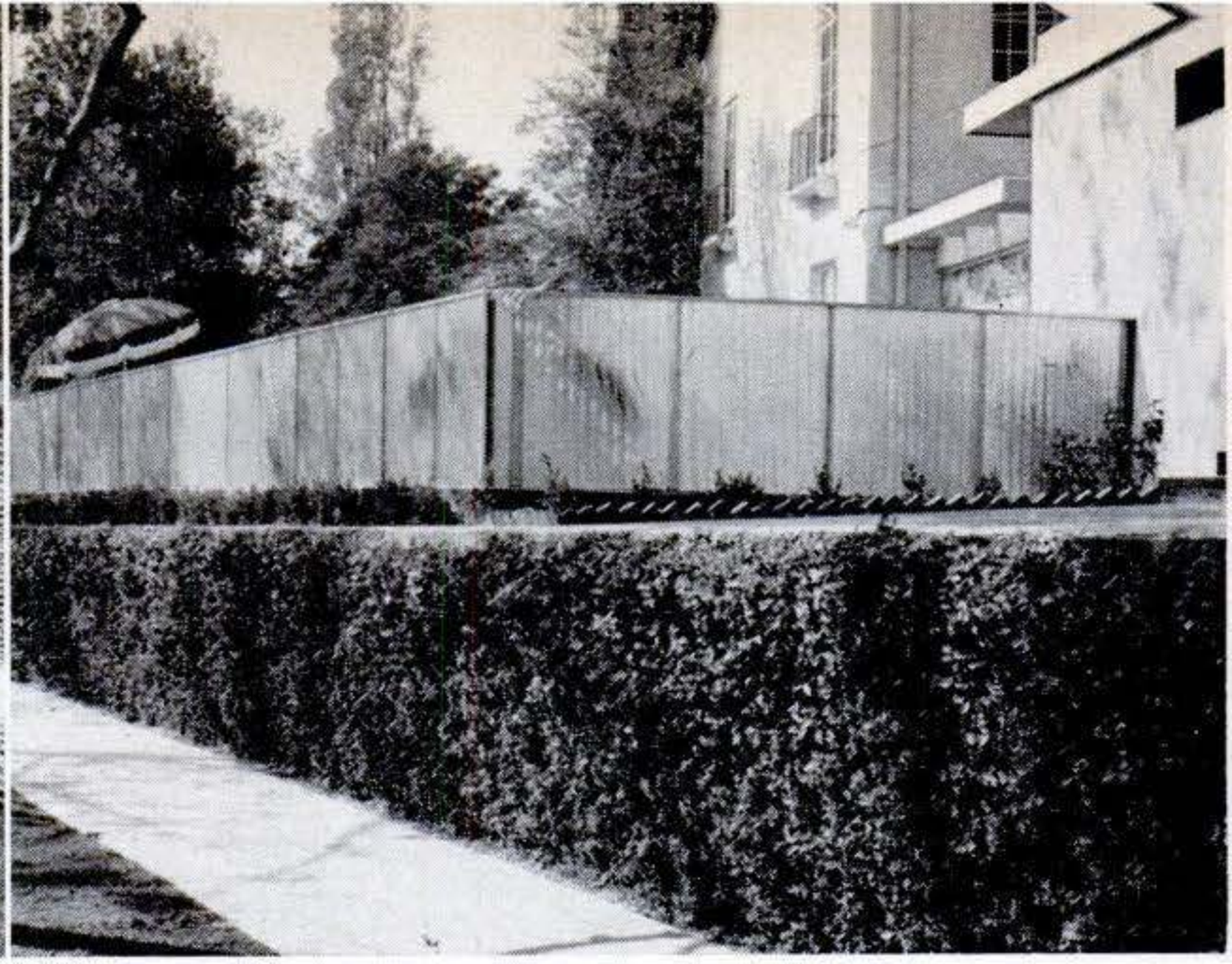




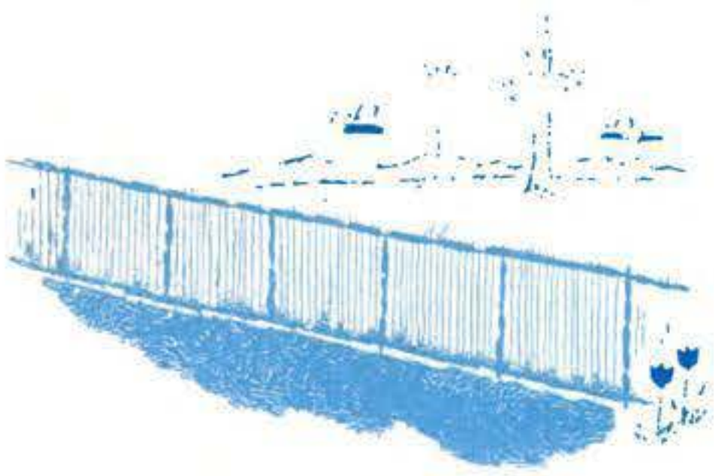
Plastic screening combines with wood strips. **Corrugated plastic affords complete privacy.**

these things, a fence can often greatly improve the looks of your place.

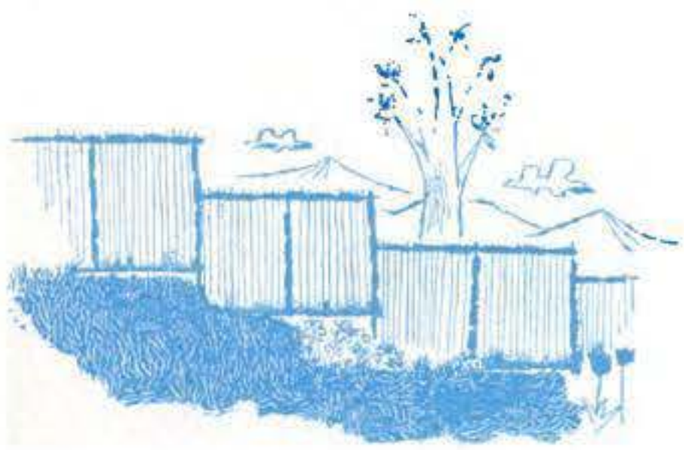
Getting started. Make a drawing, no matter how rough, before you begin work. You can size up possible materials at most fair-sized lumberyards. Even if they don't stock unconventional ingredients like corrugated plastic or asbestos, aluminum or glass, they can usually get them in a hurry.

Some of these materials won't be cheap, but they are easy to work with common tools and require little or no upkeep. Asbestos, plywood and plastic can be cut with a handsaw and put up with nails; aluminum is cut with snips and also nailed up. As for glass, it's generally simplest to order it precut to fit frames that you build.

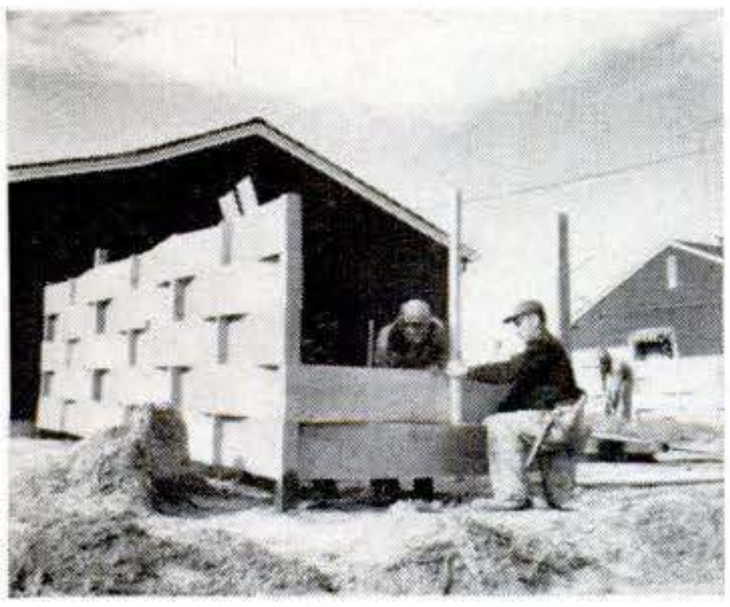
Posts and rails. If your fence is to be no higher than 4′, 4″-by-4″ posts and 2″-by-4″ rails will do. Posts should be at least 2′ longer than the height of the fence, more in soft soil. Redwood, cypress and

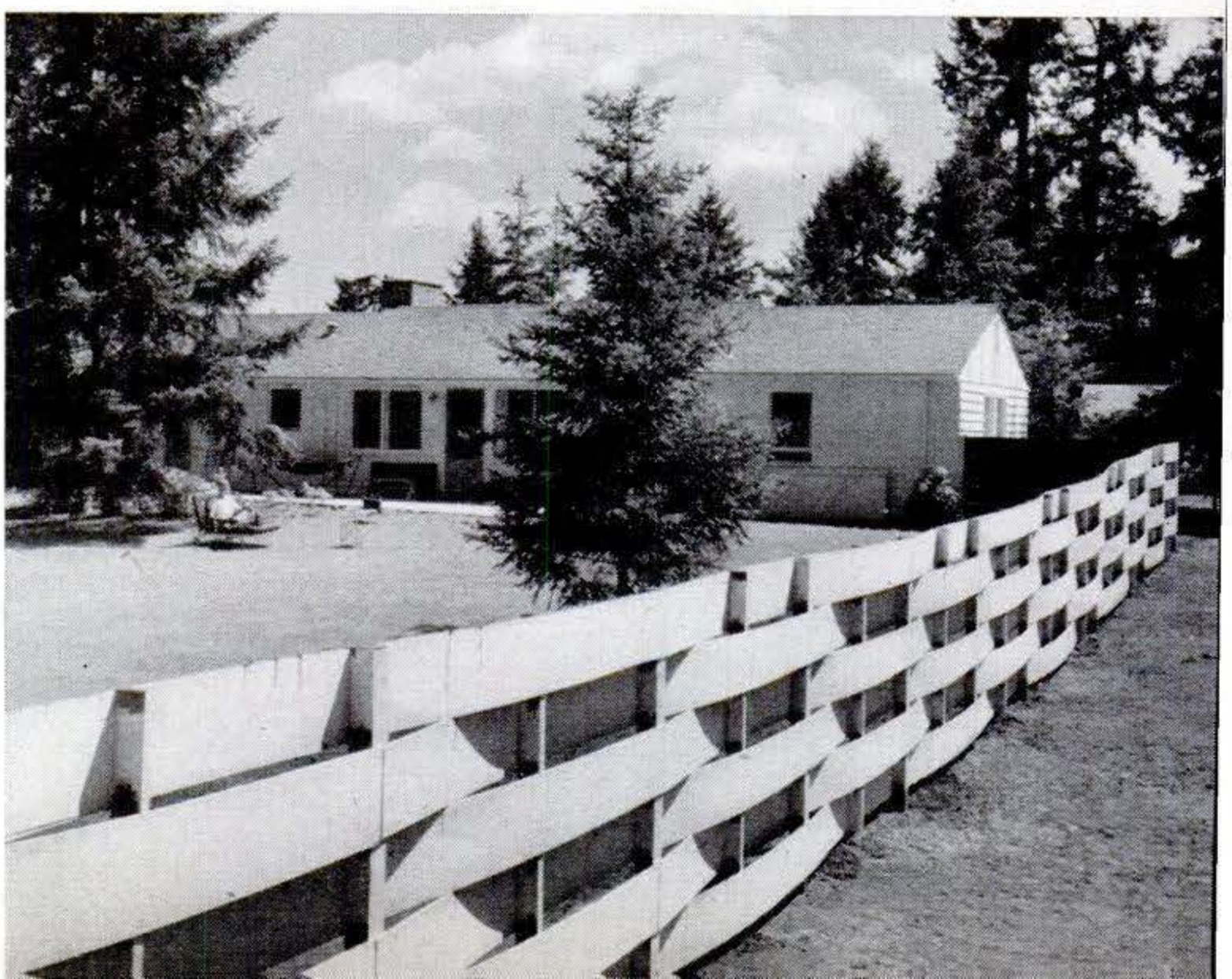


Fences can follow land, or step down.



Basket-weave fence of plywood strips.





cedar are preferred woods. Resist the temptation to use a handy tree as a post; this rarely works out well.

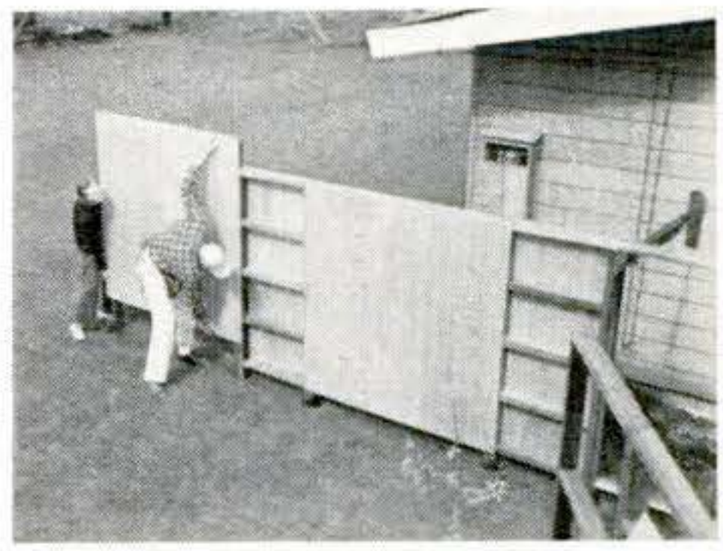
If you don't enjoy digging holes, see if you can borrow or rent a posthole digger. These outsize augers, which generate holes at a dizzy rate, can sometimes be borrowed from building-supply yards.

Build solid. Since a flimsy fence is an abomination, it's a good idea to set the posts in concrete. Don't underestimate the wind and static loads a fence may have to resist. A single 4′ panel of corrugated asbestos, 42″ wide, weighs some 50 lb., so you need a sturdy frame to hold it. If you zigzag such a fence, the panels will help to hold each other up.

If glass tempts you, investigate double-strength window glass, which is about ⅛″ thick and comes in sizes up to about 30″ by 50″. If bought in case lots, the price in my neighborhood is around 40 cents a square foot. A homeowner who wants great unbroken expanses of glass around, say, a sun deck or barbecue, may have to go to ¼″ plate glass. If the price runs too high, look into crystal glass—like plate but less perfect. Glass blocks and wire glass are other possibilities.—*Jerry Parker, Sonoma, Calif.*

Prefabricating your fence saves labor.

New grooved plywood panels, staggered on two-by-four frame, make an outdoor partition.



Units fit together on assembly.

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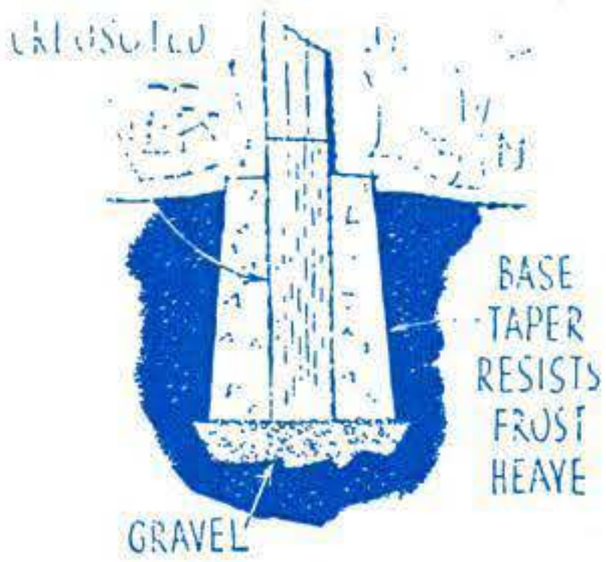
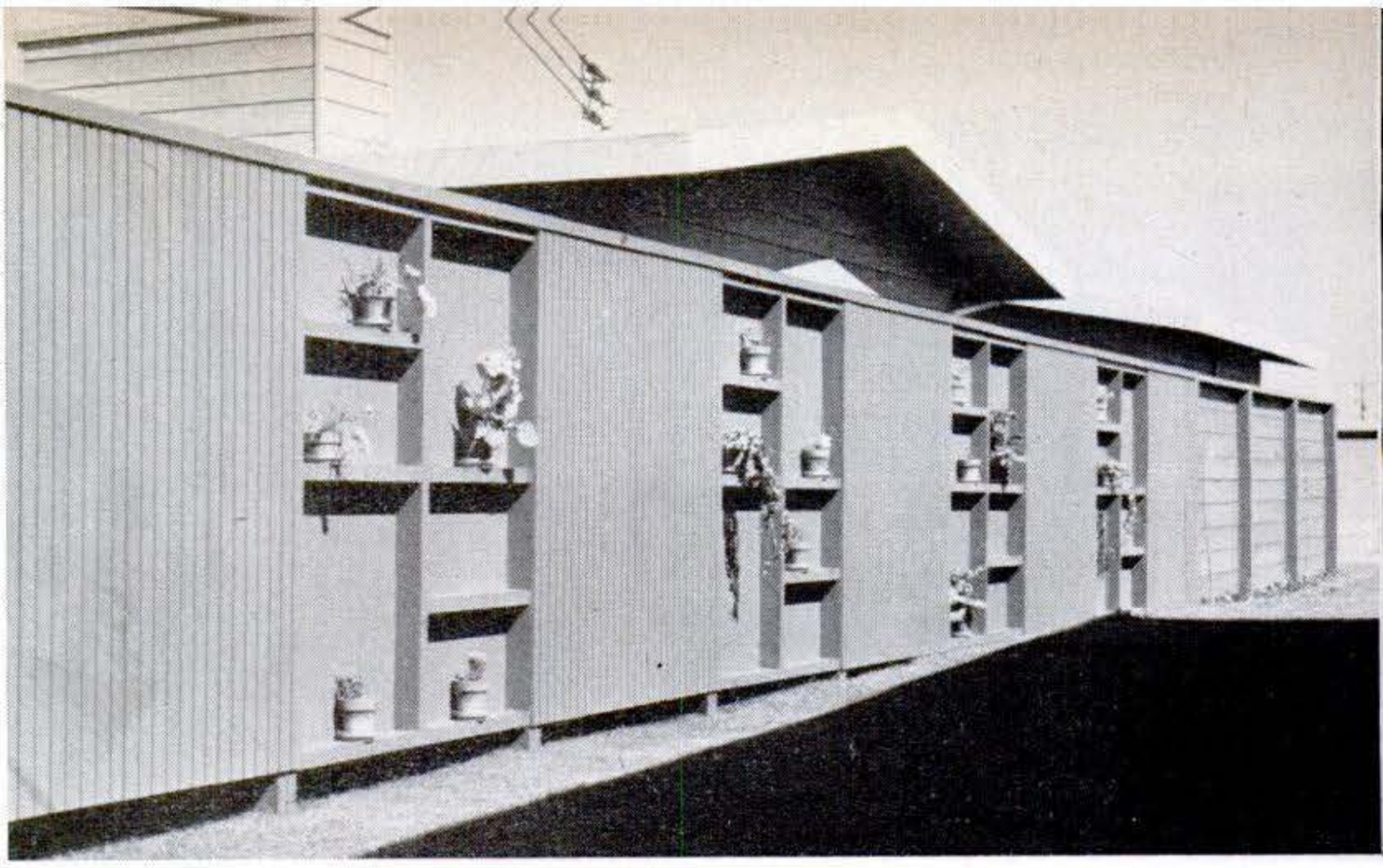
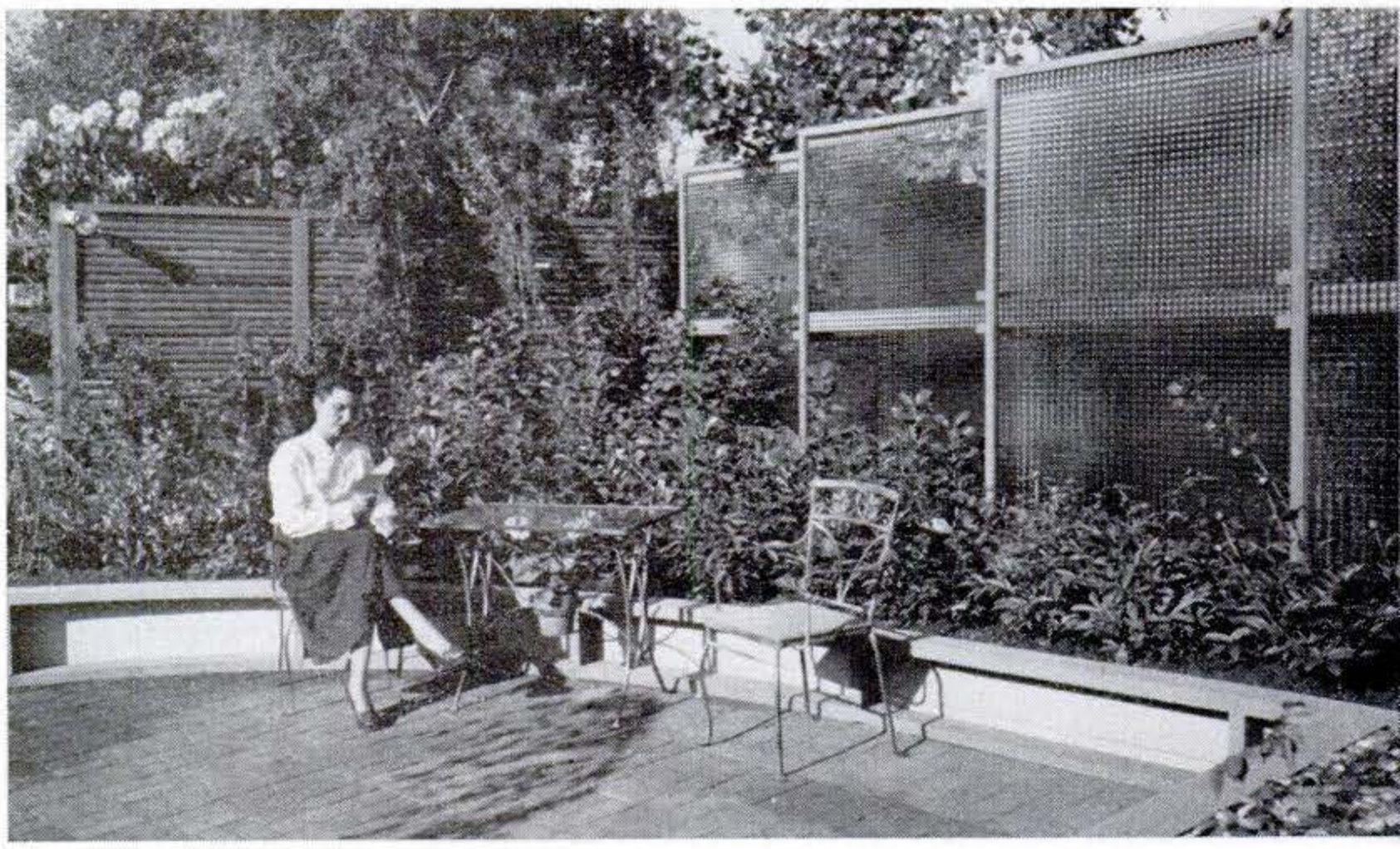




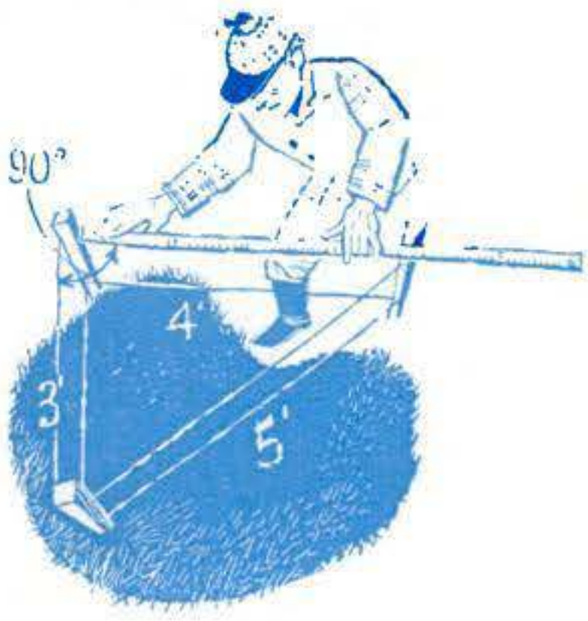
The nooks in this finished plywood fence break up its expanse.

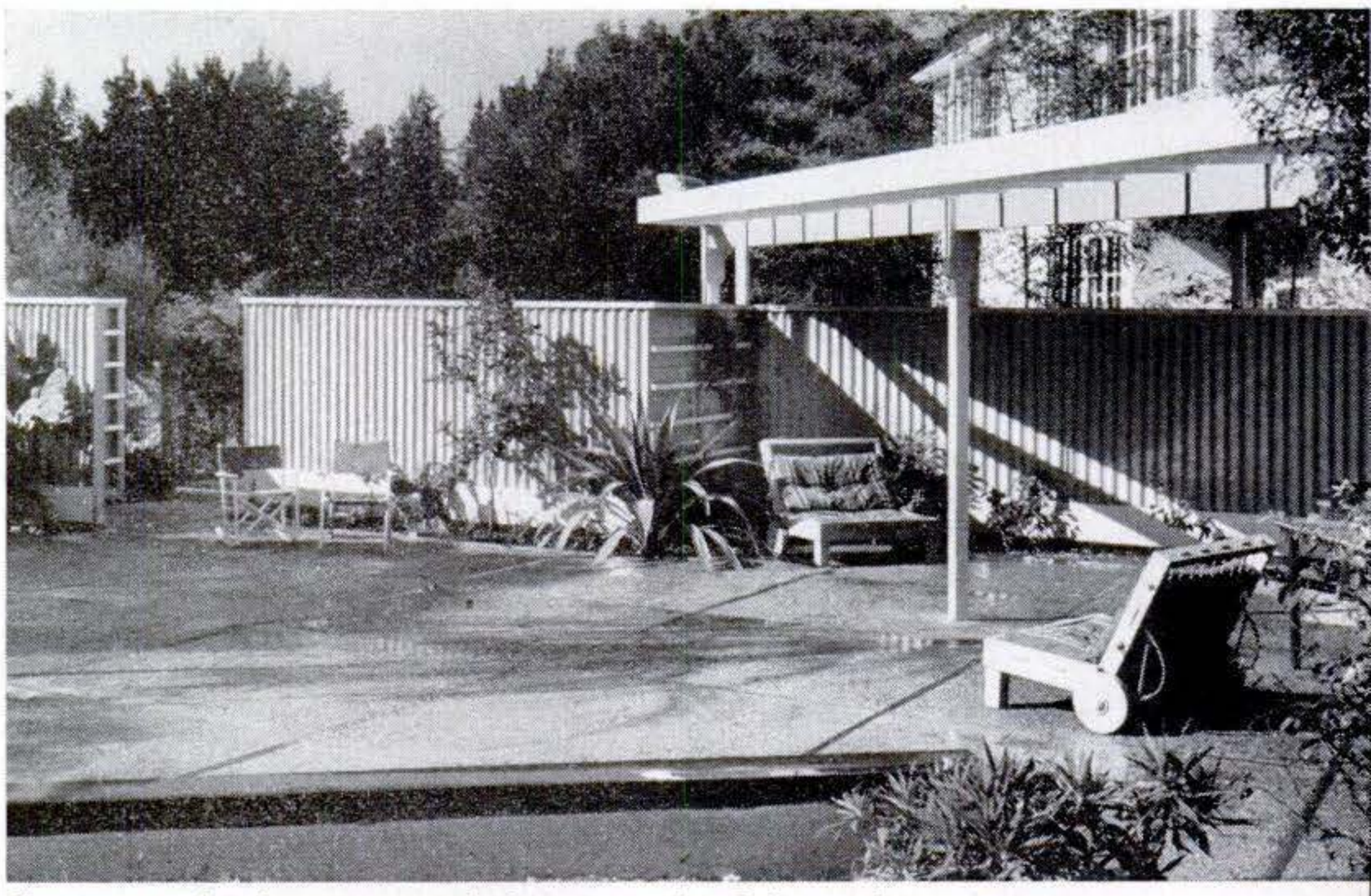
Get it straight—a little built-in waver will annoy your eye for years, even if only you can spot it.



Patterned glass panels give full privacy but do not cut light.

Don't trust your eye, nor a framing square, when establishing right-angle corner. Measure out 3′ and 4′ from provisional corner, and adjust angle until diagonal between these points is precisely 5′.





Corrugated asbestos panels have a colorful, modern appearance.

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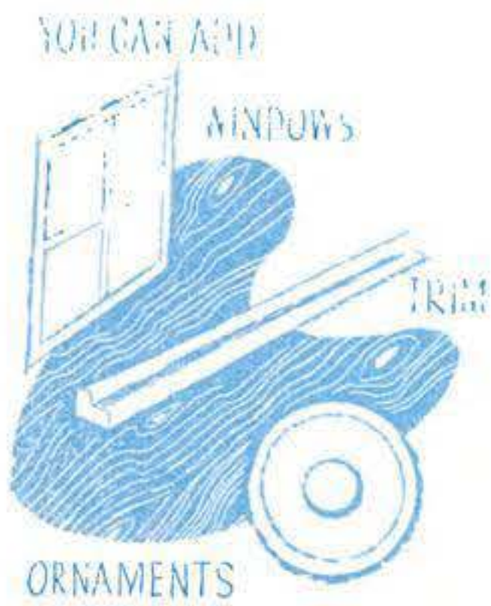
Garage Doors Can Be Beautiful, Too



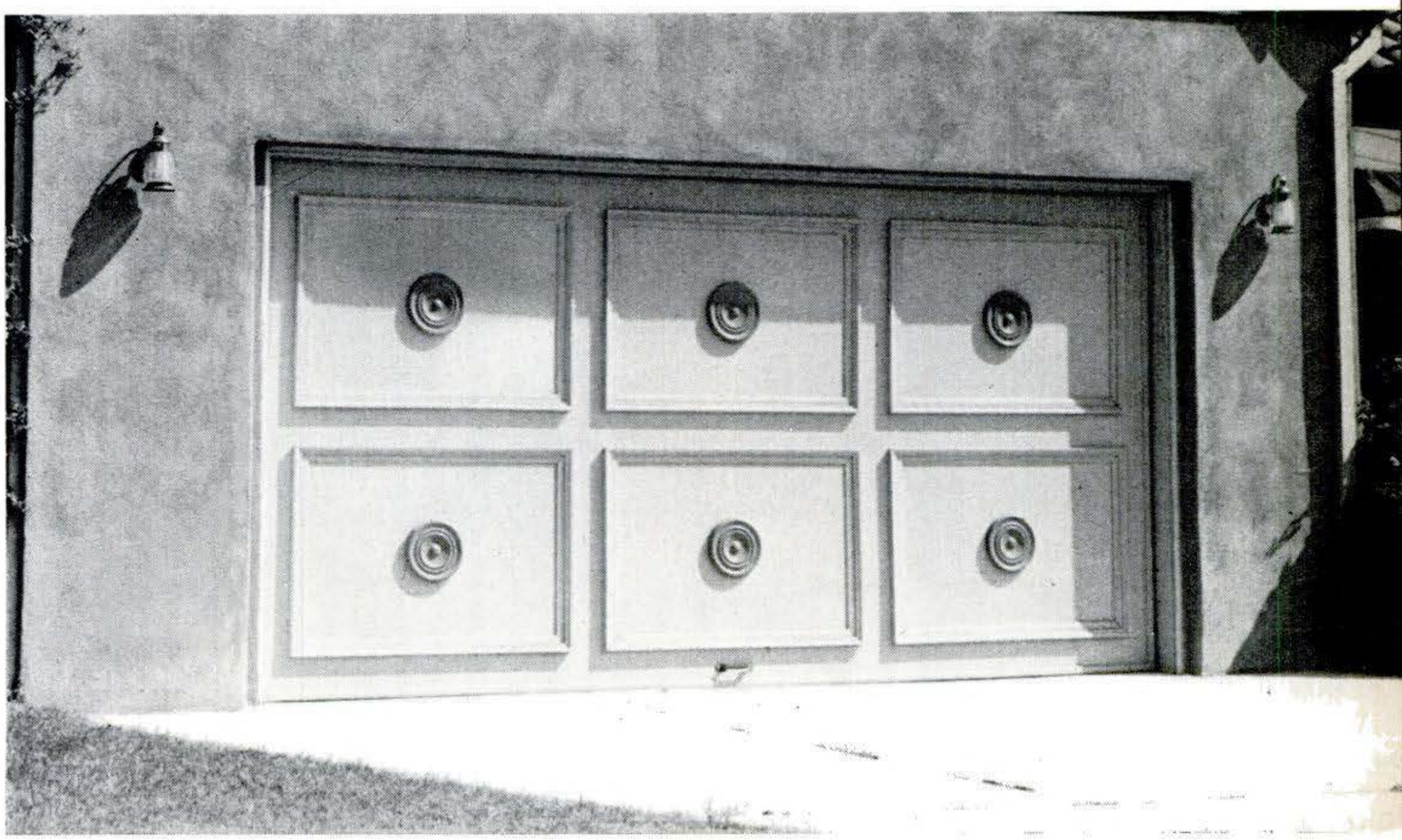
THE overbearing blankness of a garage door does nothing for a house. Nor can you relieve it with shrubs or trellises and still keep your car inside. But out West, homeowners set doors off with trim, windows, louvers or ornaments.

Such features not only ease the eye, but add a one-of-a-kind touch. "Look for the garage with green squares" is a direction visitors will readily remember.

To apply trim to metal doors, you need only drill holes and run wood screws through from inside. Corrugated doors can be disguised by covering them with outdoor plywood. Sheathing grade will do if you fill defects.

Windows and louvers for which the door must be cut through should be spaced to miss load-bearing members such as framing and braces. For more door-decorating ideas, please turn the page.—*Hi Sibley, Nuevo, Calif.*

Stock molding frames, mitered at corners, are accented with 8″ lathe-turned rosettes.



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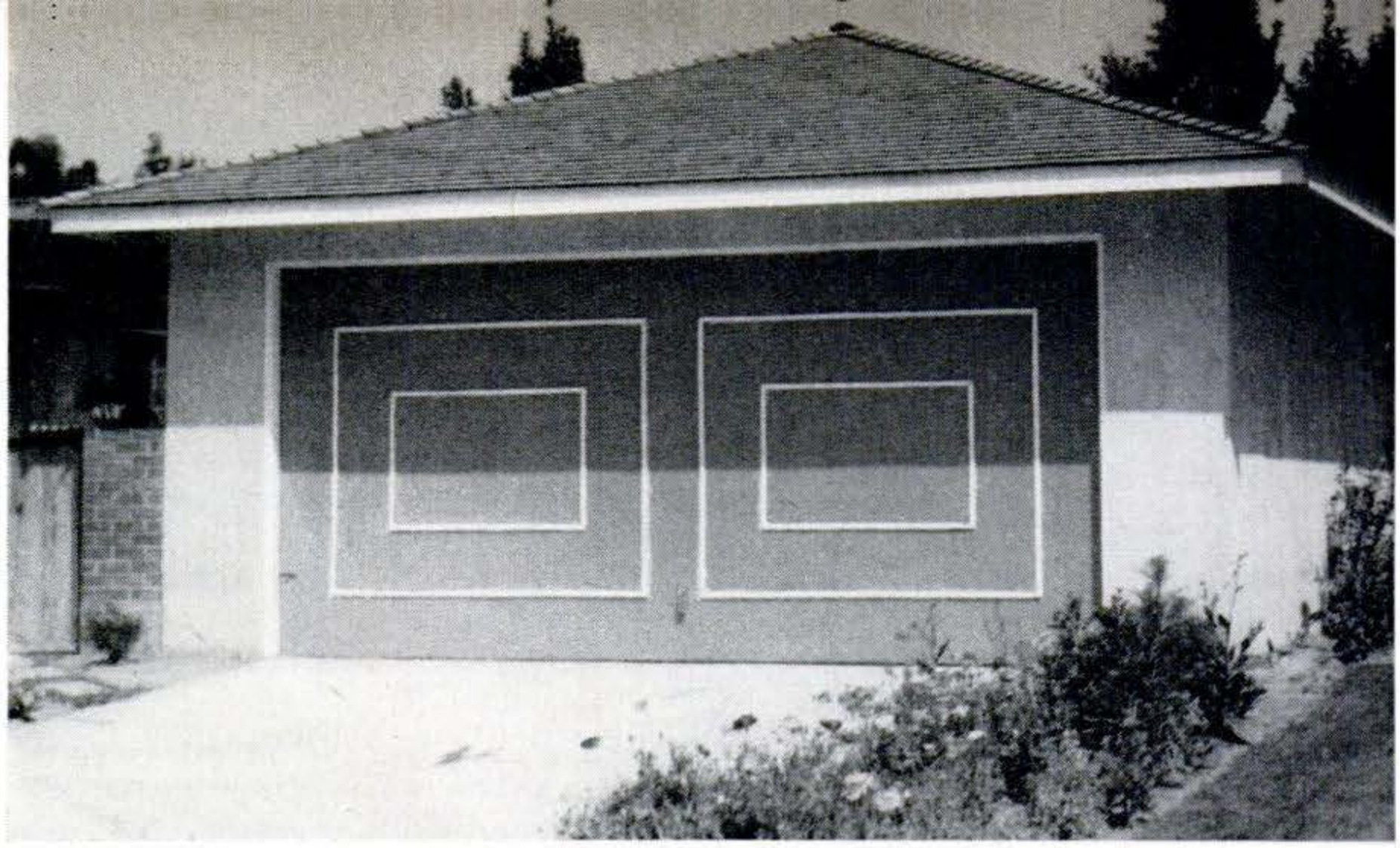
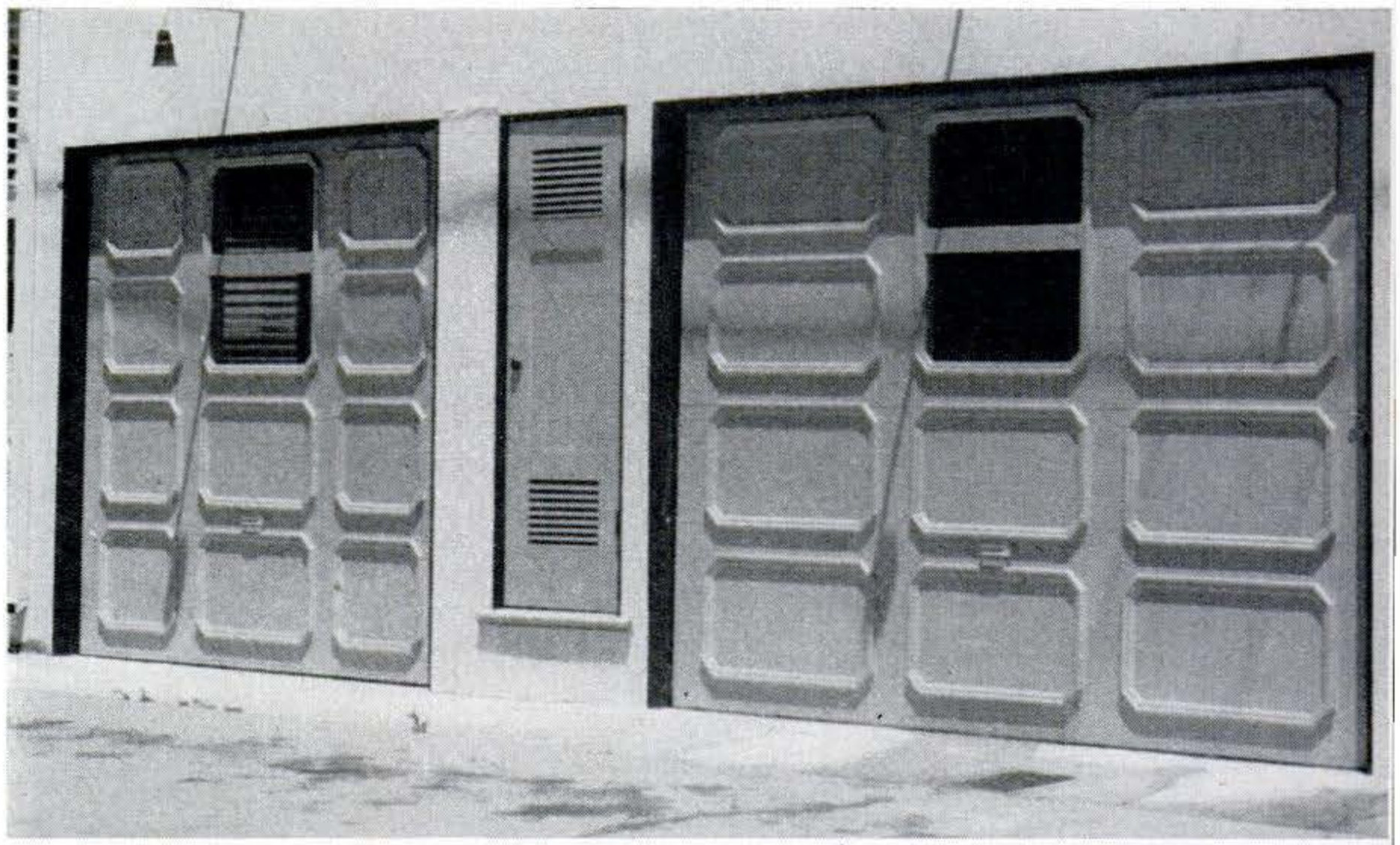
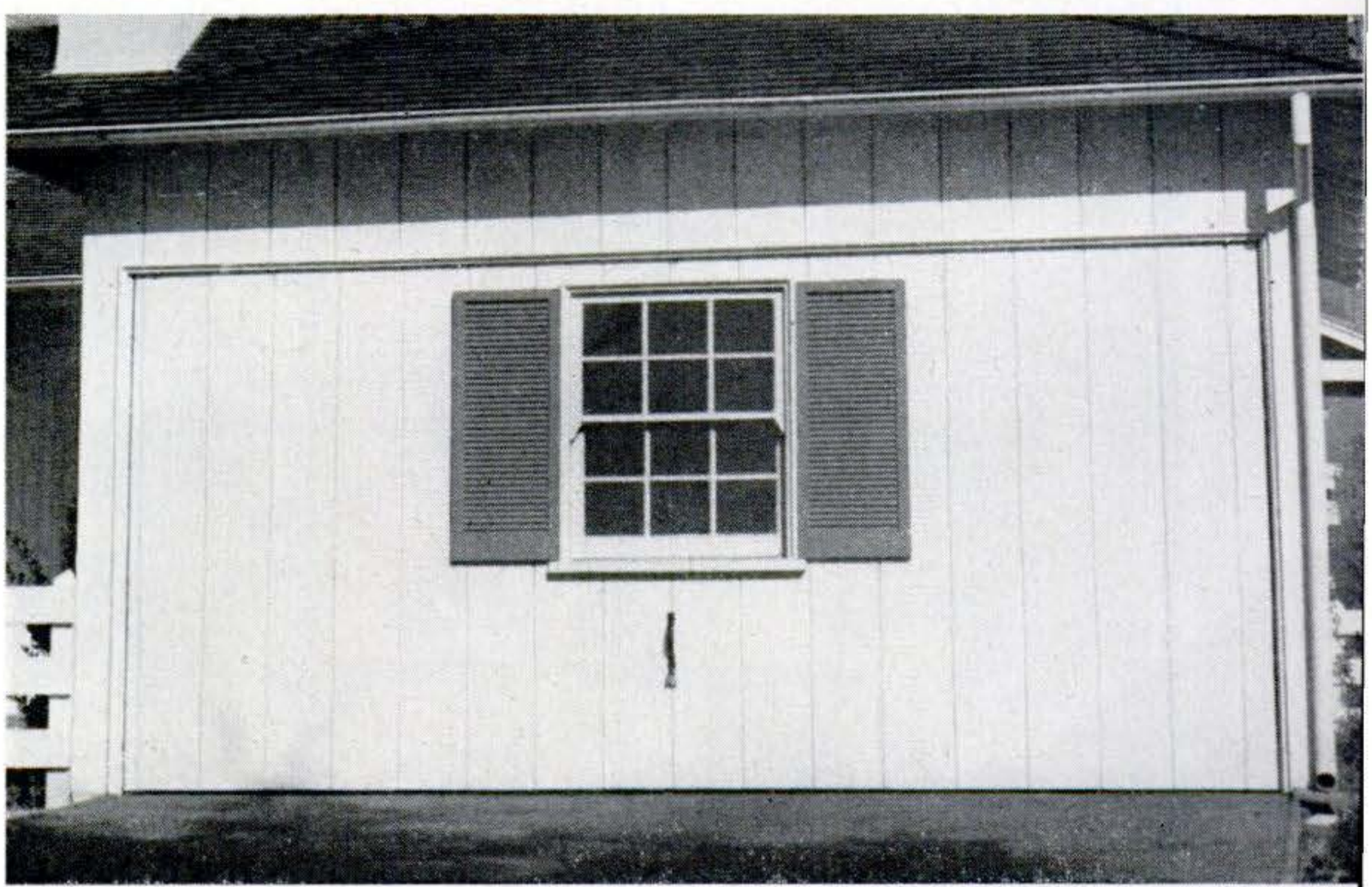


HORIZONTAL frames are suitable with a low, overhanging-roofed garage like this. White on a light-blue ground, they are simple but highly effective.



MULTIPLE FRAMES break up these two big doors. Owner used 1¼″ stock molding, with eight pieces for each frame. Clearances must be figured to permit the normal operation of an overhead door.



REAL WINDOWS, complete with shutters, relieve plainness of this big door. Hole was cut in the door to receive sash, which was retained by molding all around. The shutters are screwed in place.

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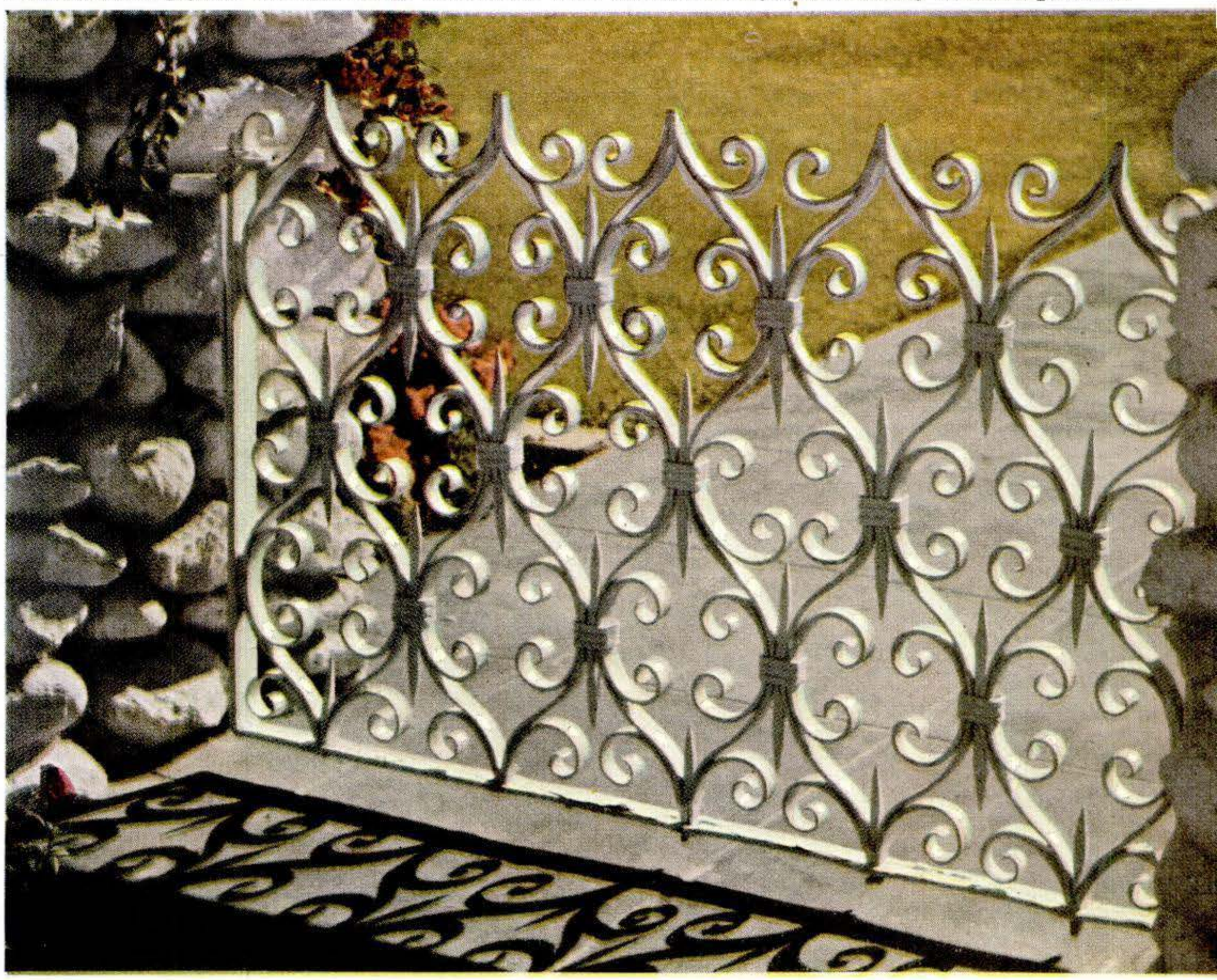
The Western Way:

Iron Gates Blend Beauty and Security

THE airy grace of wrought metal, beloved by the Spanish settlers of California, is still a favorite. Witness these wrought-iron gates, which invite even while they protect. Such gates will blend with wooden, brick or stone walls and fences. They will stand hard use and weather alike.

Design your own. Most designs can be adapted to different proportions by respacing the vertical members. Draw yours on squared paper so that you can scale it up

Blacksmithing your own gate like this takes time but is not beyond ordinary workshop skills.



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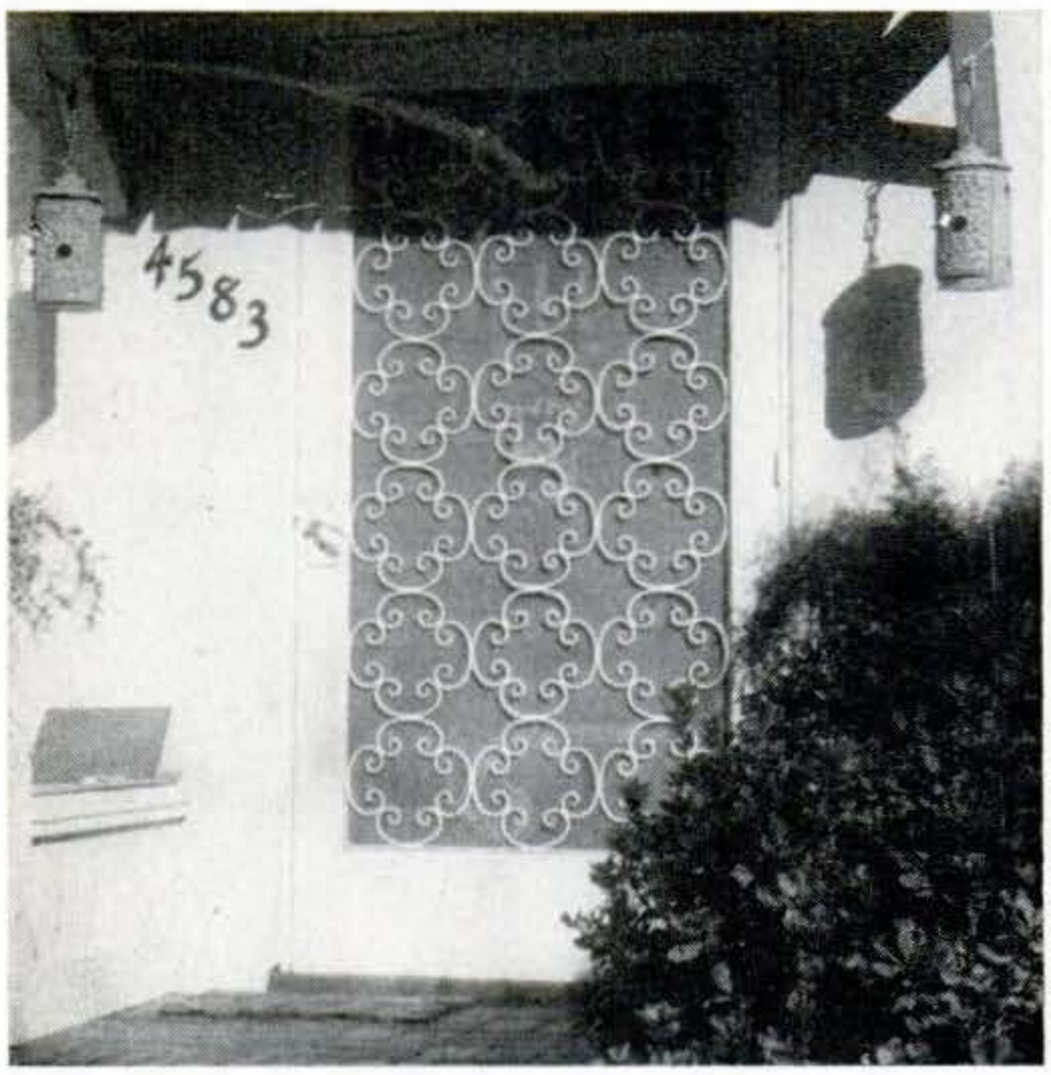
DOUBLED VERTICAL BARS, bent in a divergent curve, form the diamond shape in this gate.

TALL GATE set between brick pillars makes a restrained use of circles and simple curves.



SCROLL REPEAT has a number of units of four scrolls each. Equally good for gate or door.

LIGHT BARS INSIDE will serve perfectly well if outer framing of gate is structurally husky.

to actual size as a guide for bending the various parts.

Some welding shops will make up a gate to your drawing. But you can save money by shaping the parts yourself and having them welded, or by welding them yourself if you have the equipment. For welding, parts are simply cut to form butt joints, and there are no holes to drill. But it's also possible to build a gate with bolts, rivets or clips.

Strap iron up to 3/16″ thick can be bent cold. The 1/4″ thickness, which should be used for the outer frame and hinges, must be heated with a torch to make the sharp corner bends.

Aluminum serves, too. Strip aluminum makes an attractive gate that can be painted black or left its natural color. This material is a little easier to work than iron and of course makes a lighter gate. But it is not as easily welded, and you may have to be satisfied with riveted or clip-held joints. A couple of crisscrossed diagonal braces will greatly

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CIRCLES ON TOP add a different touch to this one. Short bars along bottom are intended to discourage stray pups from sifting through the gate. Graceful end scrolls are easy to bend.

strengthen a gate. To prevent electrolytic action, use aluminum bolts or rivets.

Shaping the metal. A husky metalworking vise is a necessity. Scrolls can be shaped with the help of a jig made of two short pieces of ½″ rod driven into tight-fitting holes in a steel block. A piece of heavy-duty pipe with a slot cut at one end is also useful.

Right-angle bends are made by clamping the piece in the vise and hammering the protruding end over. Ends can be left square or finished by flattening with hammer blows. Scroll ends should be finished before bending.

Mounting and finishing. Use lead anchors or expansion shields to hold the stationary parts of the hinges in masonry. Make sure that the line between the two hinges is plumb; if not, the gate will tend to swing one way or the other when unlatched.—*Hi Sibley, Nuevo, Calif.*

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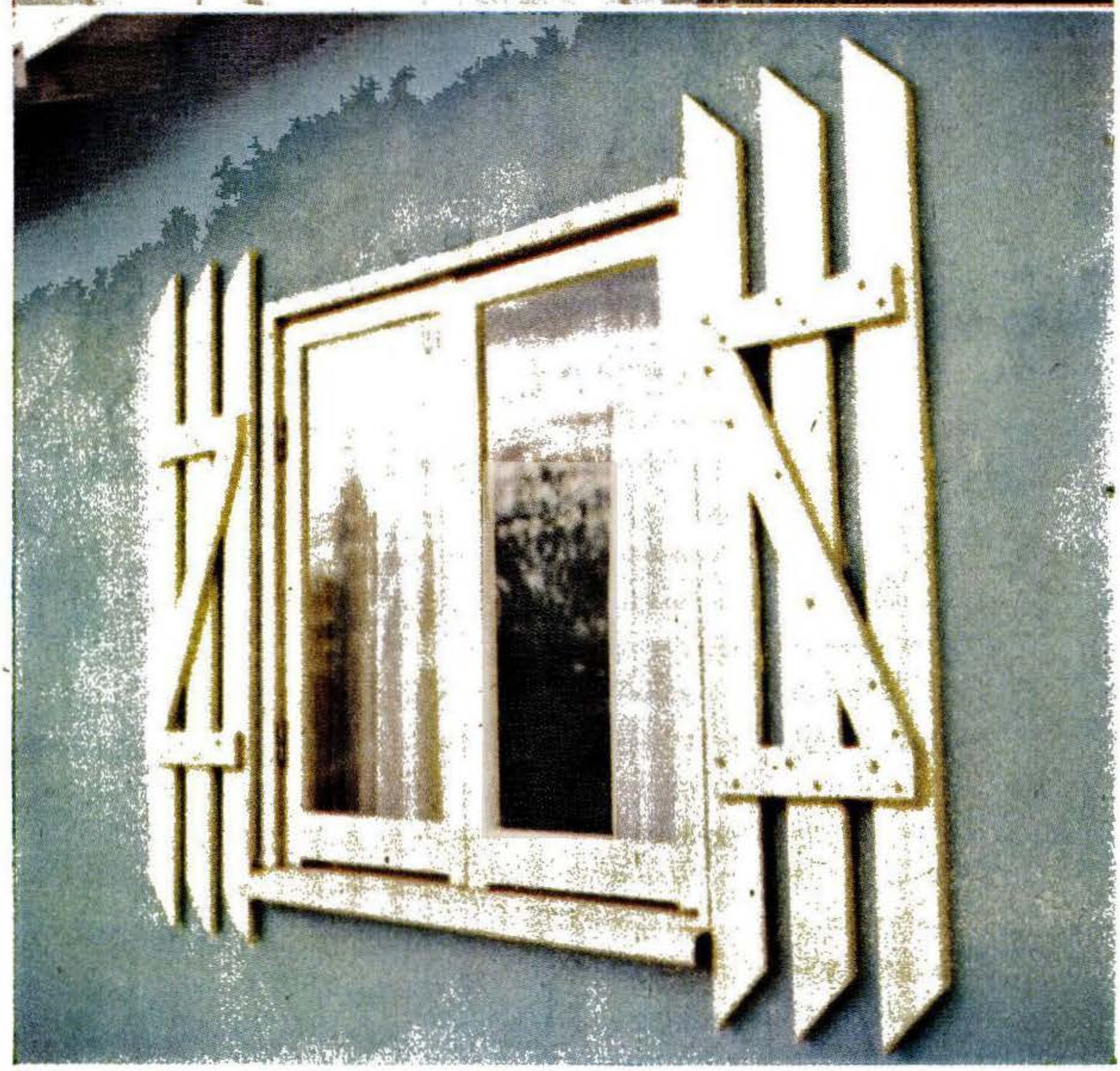
UNEQUAL WIDTH of lumber is no drawback; it may even be an advantage, as this pair shows. The central cutout is a simple jigsaw job; with a tool of sufficient capacity, you can stack the stock, cut several at once.

The easiest shutters to make at home are ones with plank-and-cleat construction



SIMPLICITY doesn't spoil the effect if shutters are well suited to the character of the house. In designing your own, it's a good idea to rough together a pair, stick them up temporarily to see how they look.

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The Western Way:

Distinctive Shutters Add a Gay Note

A HOUSE without shutters, many homeowners feel, is not equipped for gracious living.

Shutters, let's face it, will not better your job, improve your digestion or restore falling hair. But as Westerners know, they *will* work some predictable magic:

Shutters make a house go through that same change-for-the-better that you yourself do when you switch from a rust-stained T-shirt to a newly laundered sports shirt.

Shutters literally add to the value of your property. A little money here can mean big money in resale value.

Shutters offer an excellent way to individualize your house

COLOR COMBINATIONS make a lot of difference in the effectiveness of shutters. This pair of louvered jobs was painted a shade to contrast dramatically with the wall and lower course. Flower box is part of design.

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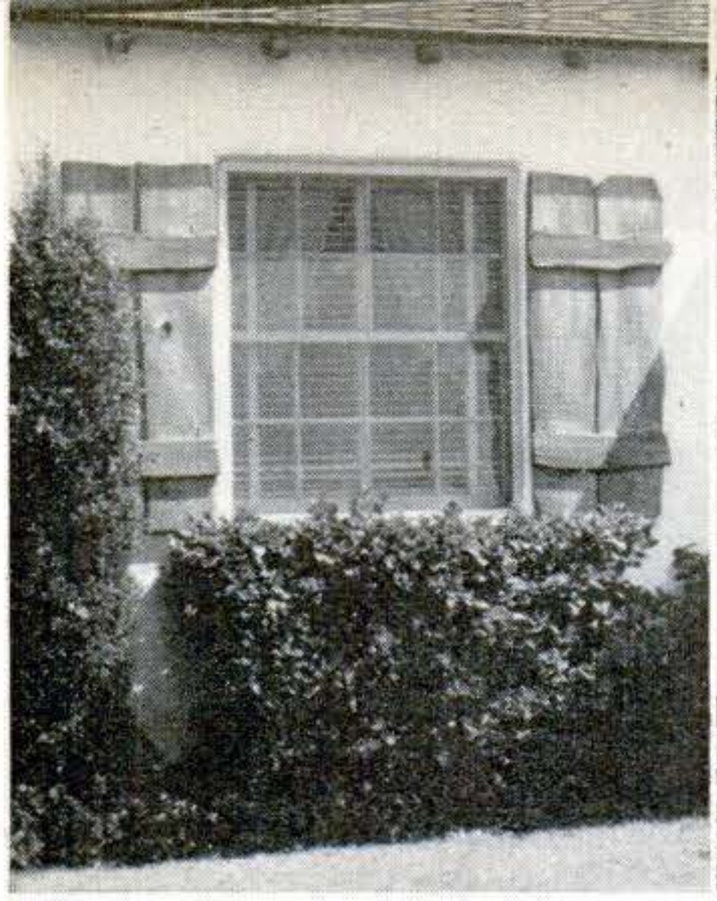
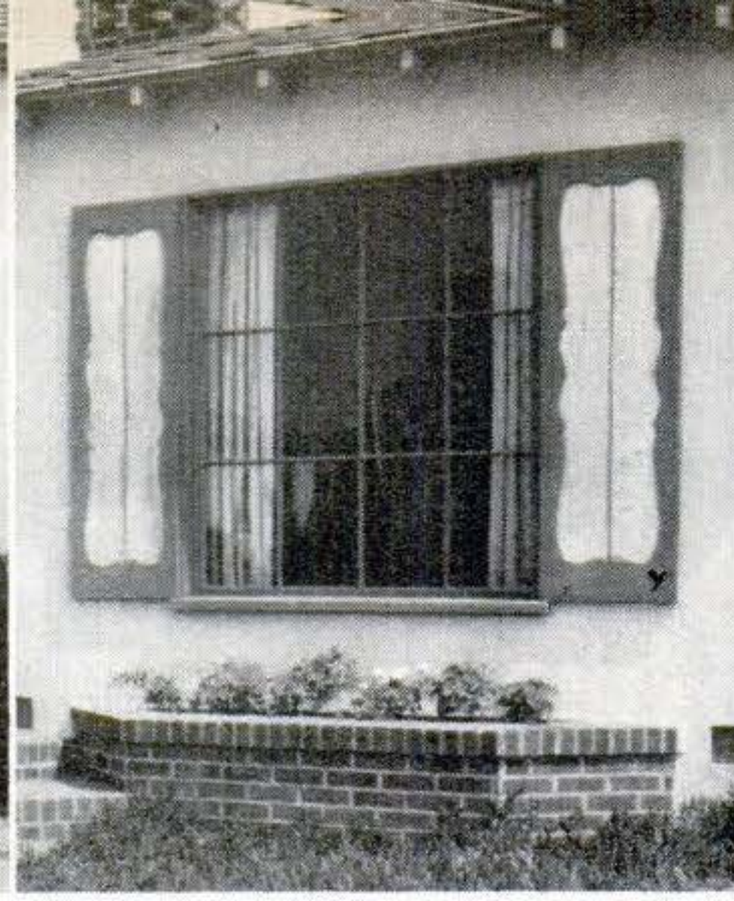
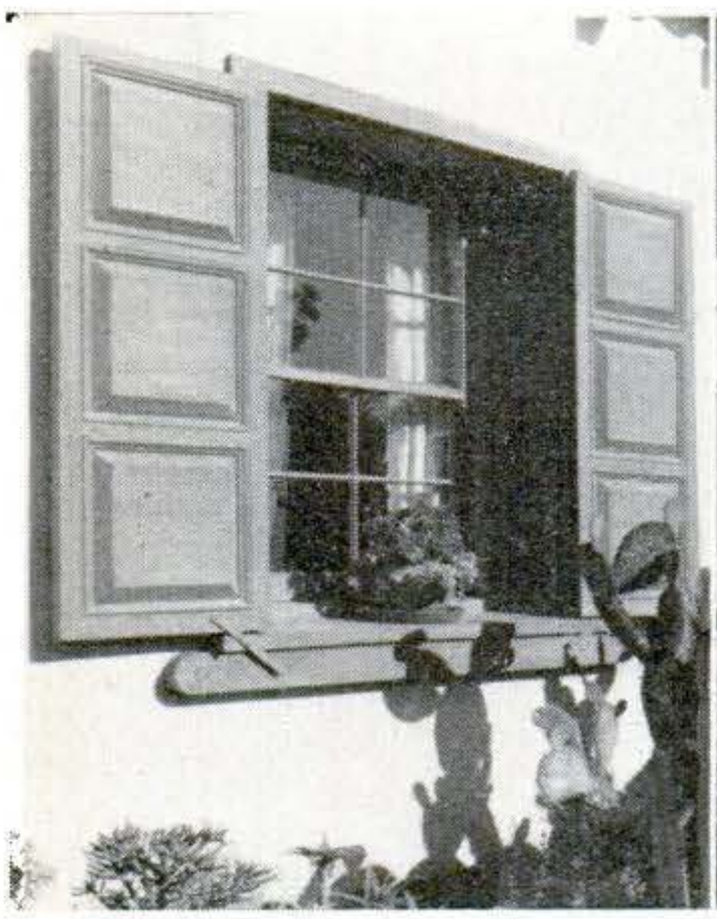


WEATHERED SLABS, irregular edges, give fairy-tale look.



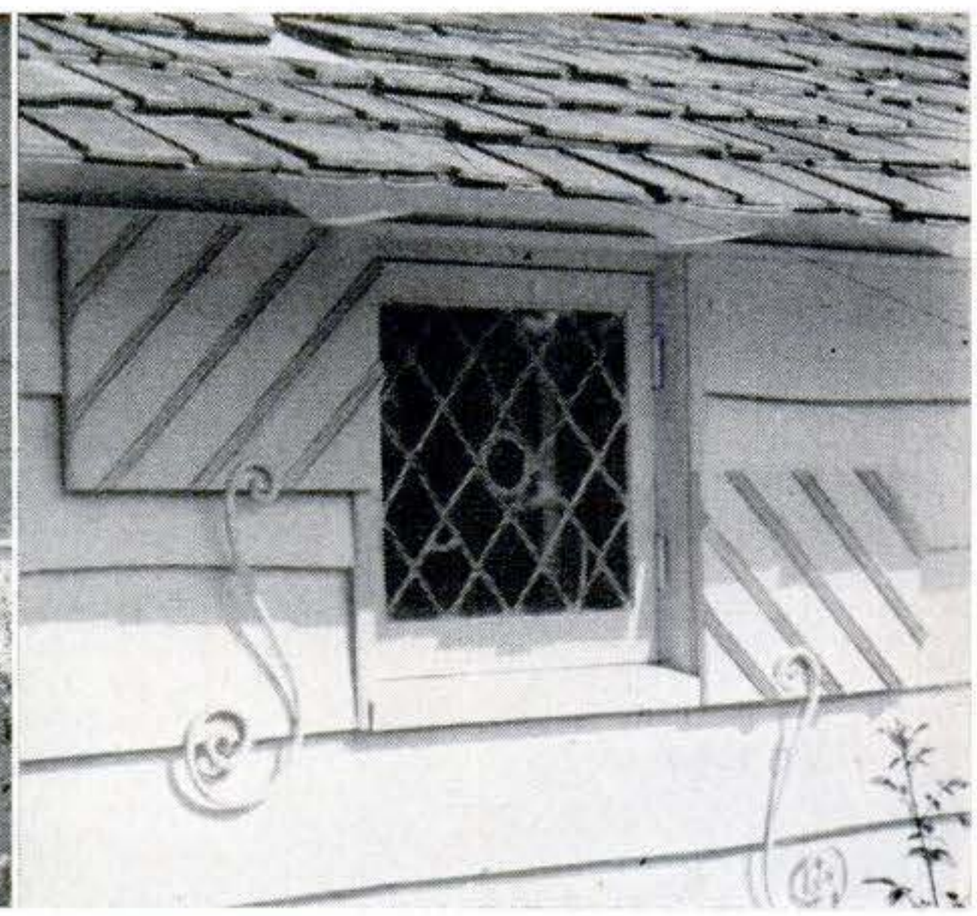
BANDSAWED FRAME trims up these plain planks neatly.

JIGSAWED DECOR, like this, dresses up plywood panels.



RAISED PANEL, with molded edging, gives elegant touch.

POTS contribute a perky little touch to these fine blinds.



DUTCH-DOOR pair can be decorated with molding strips.

—to make it your own and no one else's. This doesn't necessarily mean that if you are a dentist, say, you should jigsaw out of each shutter the silhouette of a freshly extracted three-root molar. But it does mean that there is often some special design or device that will say "Home" to you and the wife and kids.

The easy way. Nothing prevents you from hiring a contractor to install factory-built, working-hinged shutters—except maybe your bank account. New shutters are not cheap, and they can call for a good deal of special hardware and costly hand-fitting.

The easier way. This is to scout building wreckers' yards for a heap of shutters. Pick ones that come within an inch or two of matching the height of your window casings; a closer match isn't visually needed. Lug them home, let your wife go through the strange female rite of selecting just the right color, and spray-paint the lot. Nail or screw them on.

Homemade jobs. If local yards offer slim pickings, it isn't hard to build your own if you use plank-and-cleat construction. Lumber can be fairly rough as long as it is sound. END

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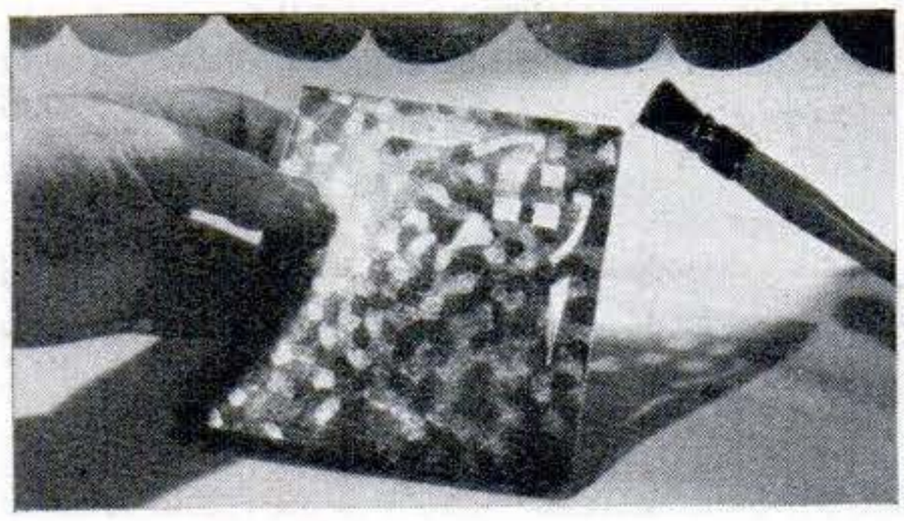
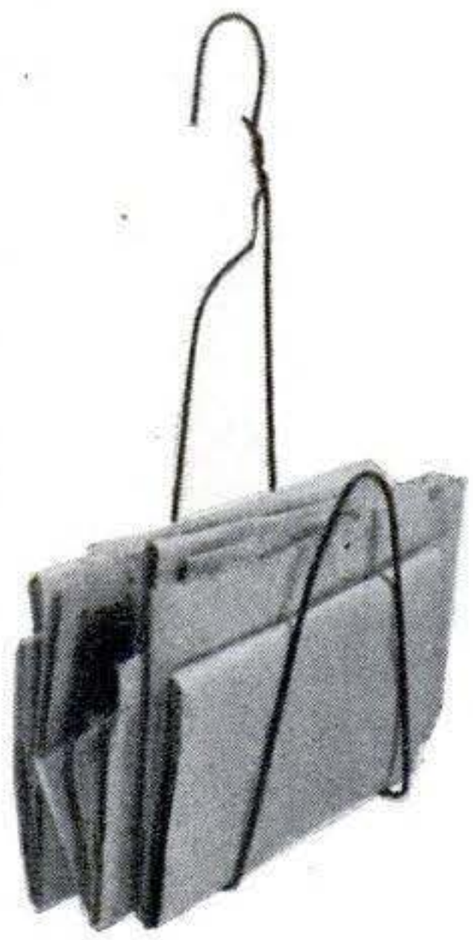
DO IT THE EASY WAY

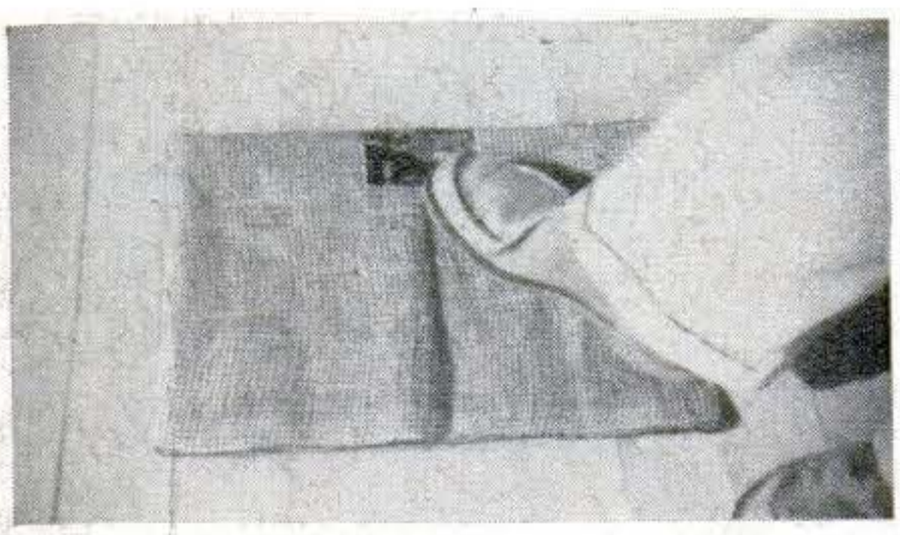
CLOTHESLINE GET TANGLED? Ask a local movie house for a discarded film reel and wind and store it on this. An 18" reel will take 200 feet of line.



A DURABLE STENCIL for wall or other decoration can be cut from a scrap of reflective aluminum insulation. It wipes free of paint in a jiffy.

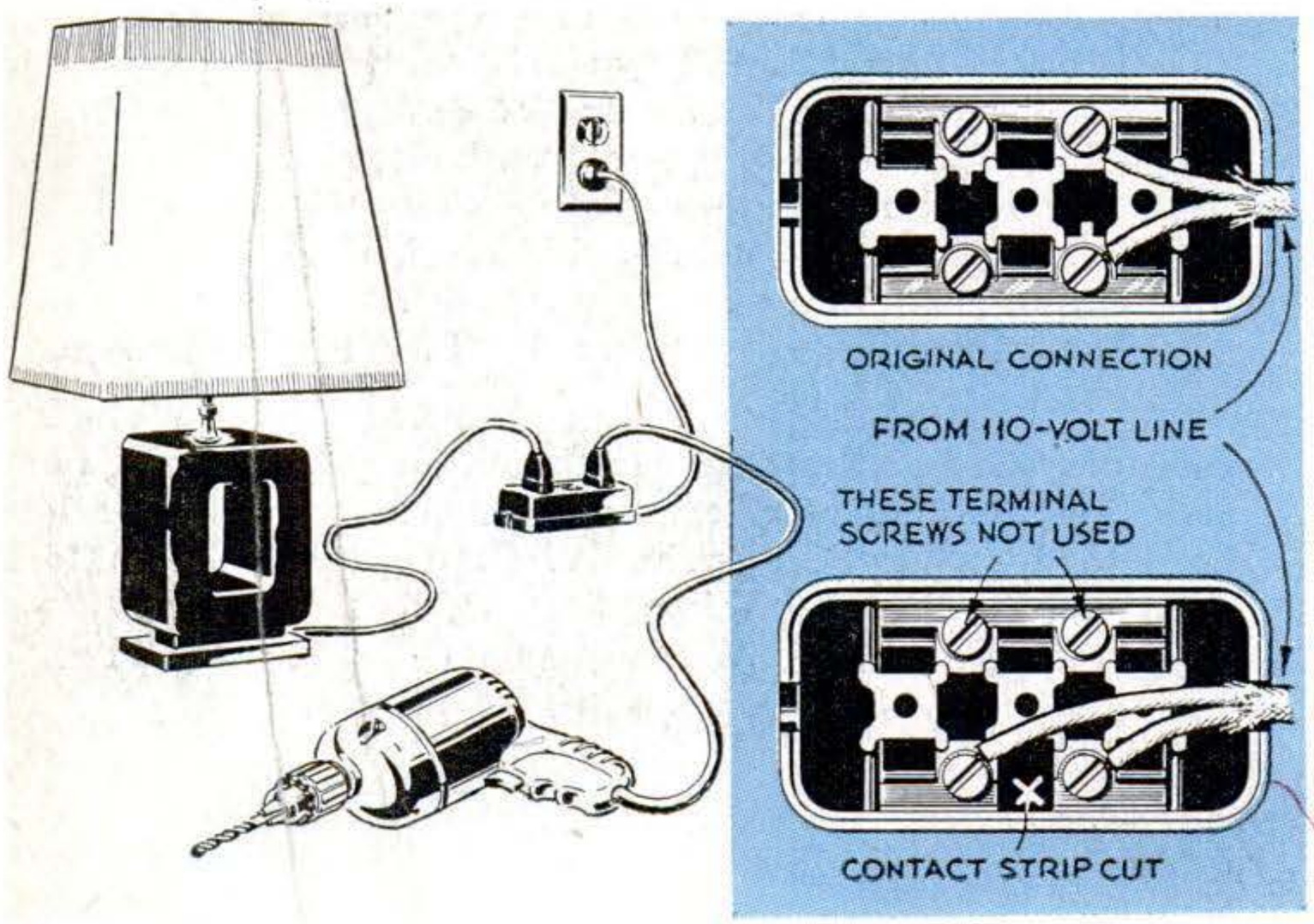
A HOLDER for paper bags in the home kitchen is quickly fashioned from a wire coat hanger. Pull it out lengthwise with the hook at the top and then bend up the bottom in a sweeping curve. A spring action will grip the stored bags if the upcurving part is bent back a bit. Hang the holder on the back of a door.





A HOMEMADE MAT at the door will help keep mud out of the house on rainy days. Just stuff 10 or 12 newspaper pages inside an onion or orange bag.

Lamp Wired in Series with Drill Reduces Its Speed



WHEN drilling plastics and other materials, you sometimes need to use a slow drill speed. Regular speed reducers are costly, so I rigged up this homemade resistor to do the job.

The extension outlet, rewired as shown, permits an ordinary lamp to be connected in series with the drill, and the added resistance slows down the drill's speed. — *Frank Victor, NYC.*

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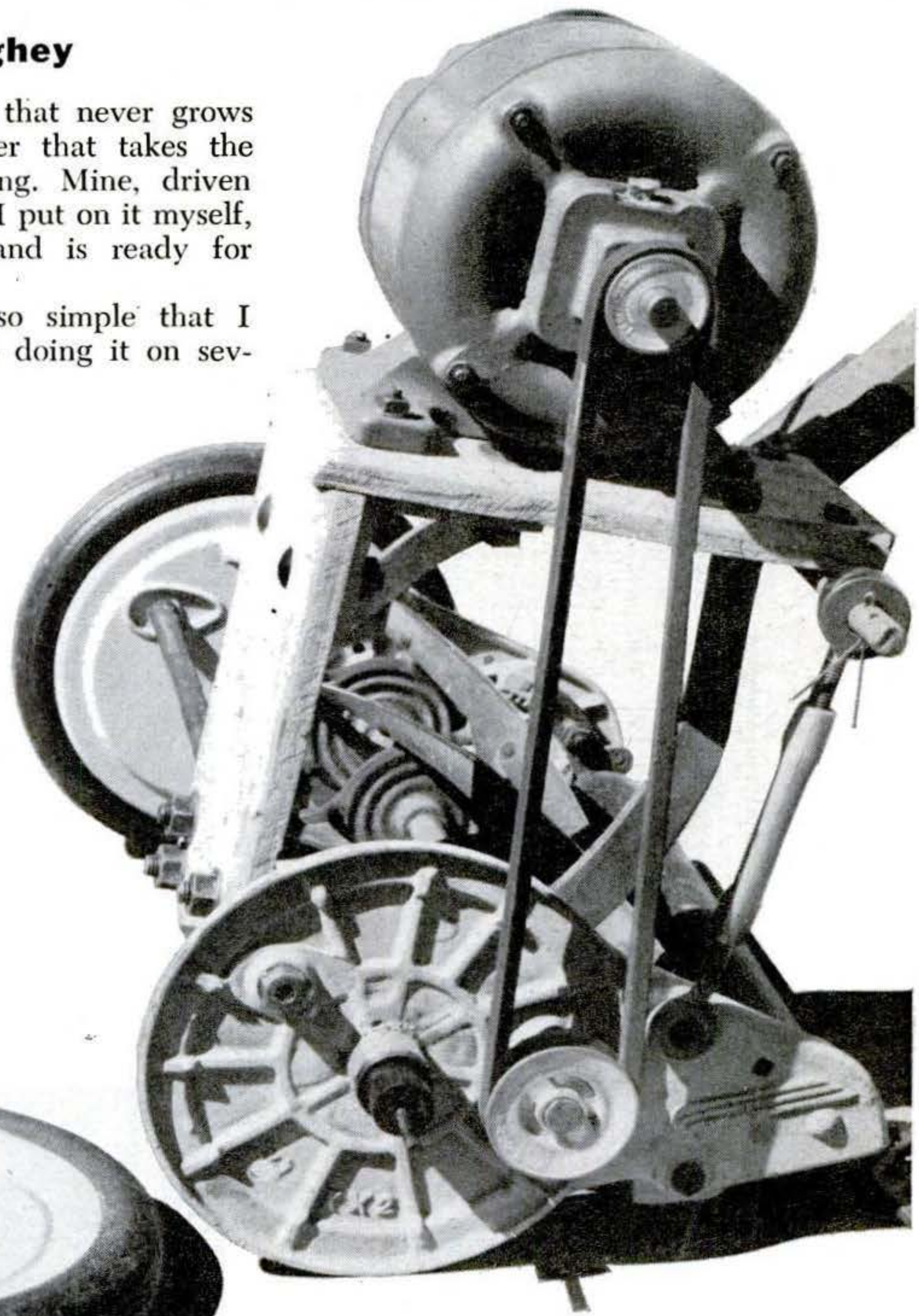
How to Power a Hand Mower in One Evening

Once you hitch it to an electric motor, cutting the grass becomes little more work than taking a stroll on your lawn.

By Carroll McGaughey

NEXT best to a lawn that never grows too high is a mower that takes the sweat out of grass cutting. Mine, driven by an electric motor that I put on it myself, did so all last season and is ready for another.

This conversion was so simple that I let myself be talked into doing it on sev-



THE JOB IS EASY because you do not have to cut the reel blades short to make room for a pulley. Instead, the pulley goes outside the side frame like this. The mower wheel (here removed) is held out by a spacer on the axle just far enough to clear the pulley. A motor mount is made of two pieces of wood and clamped to the front tie bar. A large turnbuckle provides belt tension.

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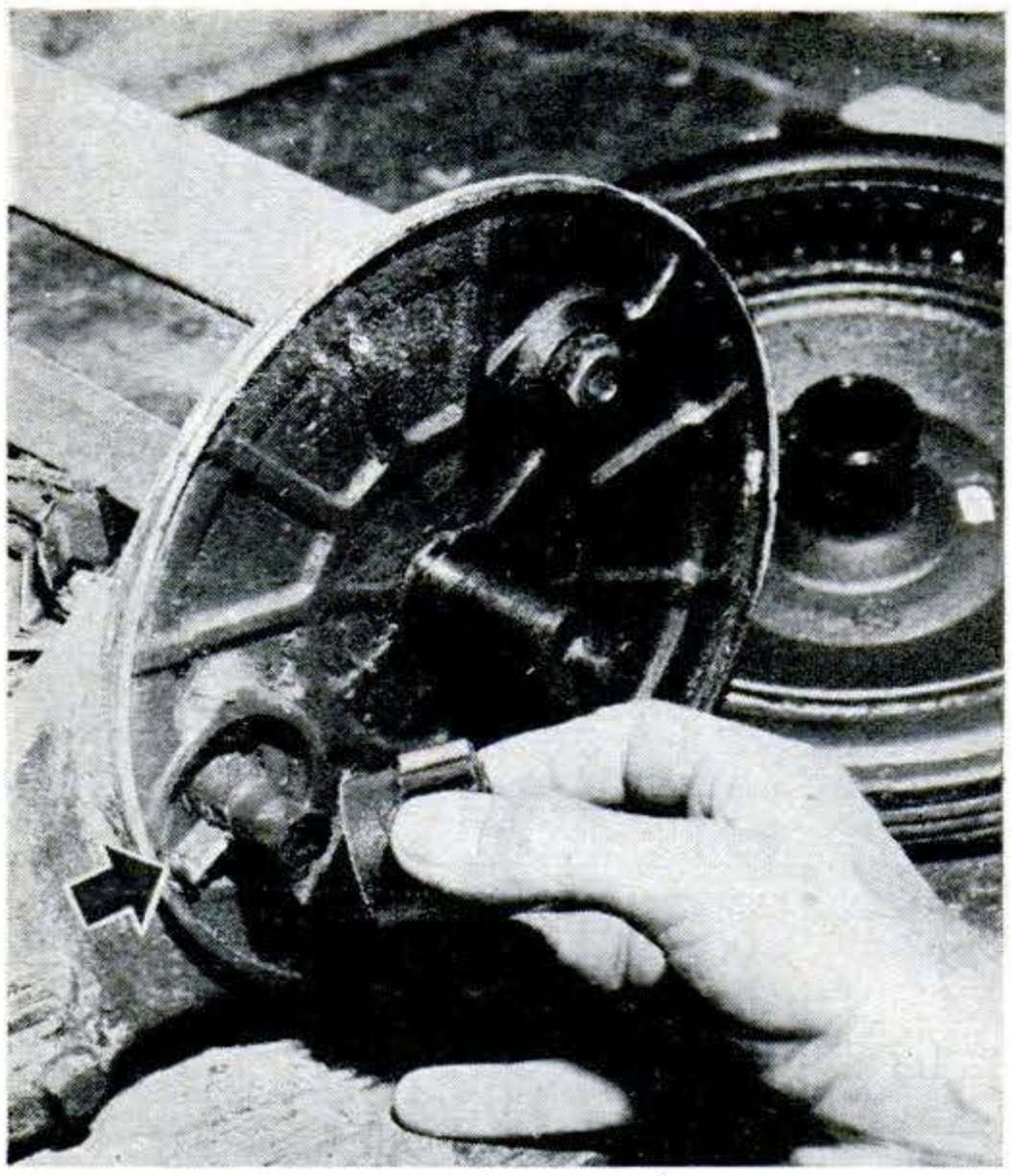


REMOVE EACH WHEEL and pull the small pinion gear off the end of the reel shaft. Then push the pawl (arrow) out of its slot in the shaft. Having decided which side of the mower the motor will go on, replace the opposite wheel, leaving out pawl and pinion.

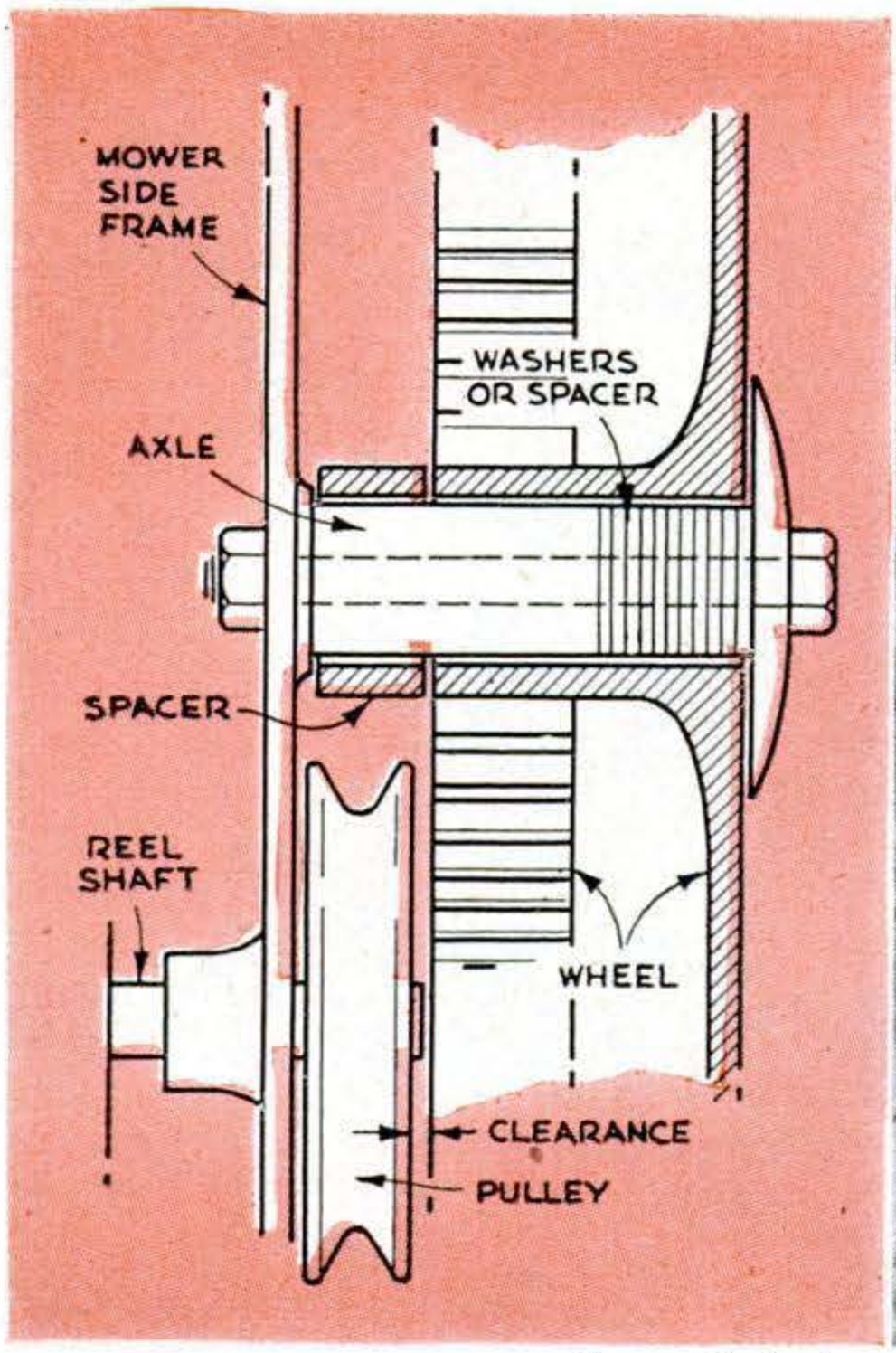
eral neighbors' mowers. These run fine, too.

Apart from the motor, materials cost only three or four dollars. No major change is made in the mower—you remove only the pinions and pawls that drive the cutting reel. The motor will do that. You still have to push the mower, but this is easy when the wheels are not spinning the reel. Should you ever want to go back to muscle mowing (wanna bet?) or trade the machine in, you can reconvert it in half an hour.

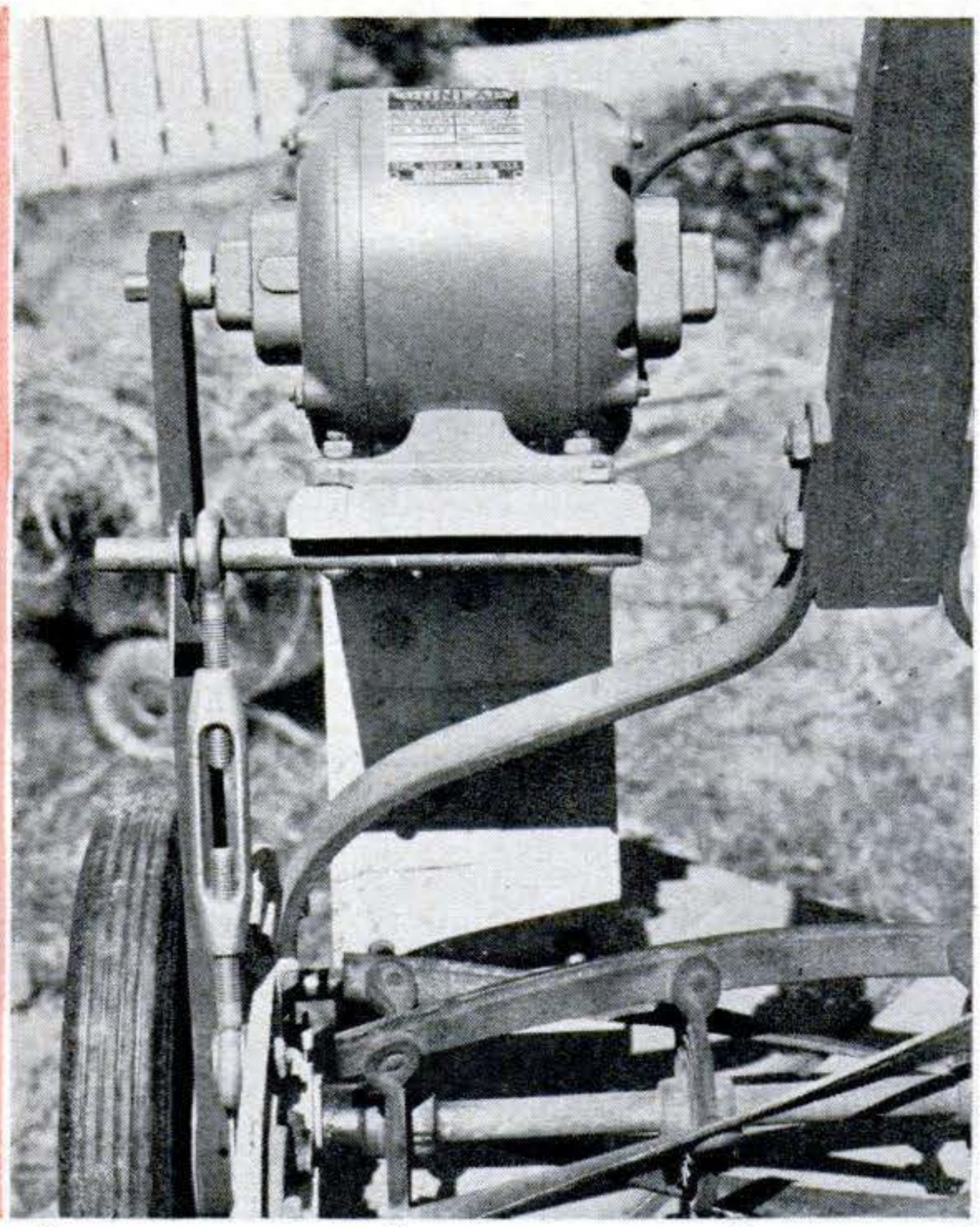
Although I find a ¼-hp. motor adequate even for heavy grass, a ⅓-hp. unit will give a desirable reserve of power. Also, because friction between reel and cutter bar creates a high starting load, it is a good idea to use a capacitor-start motor.

To go electric, first remove the axle bolts and take off both wheels. Then pull off the pinions and push the pawls out of their slots in the reel shaft.

Look at your motor to see which way it turns from the drive-pulley end. Then decide on which side of the mower it should be mounted to spin the reel forward. The rig shown has the motor on the left, but if



A HUBLESS PULLEY goes on the reel shaft and a spacer is put on the wheel axle to hold the wheel out of contact with it. About 1″ of the axle should still enter the wheel bearing. Put washers or a second spacer on the axle bolt to keep it from clamping the wheel.



AT THE REAR the motor mount is supported by a husky turnbuckle, which can also tilt it up or down to adjust belt tension. A washer and cotter pin retain the turnbuckle on a rod bolted to the rear of the mount. The lower eye is bolted to the mower side frame.

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yours runs the other way, you may find it easier to turn it around and mount it on the right than to reverse it electrically. Now replace the wheel on the other side, leaving out the pawl and pinion.

At the end of the reel shaft on the motor side, mount a 2½" hubless pulley. It is a good idea to drill a dimple or file a flat in the shaft as a seat for the setscrew.

Wheel Axle Is Extended

The mower wheel will now hit the pulley, but it should still bear on the axle for about an inch. This is enough to carry the weight of the machine. The wheel must be held out of contact with the pulley while as close to it as possible. For this you will need a longer axle bolt and a spacer. Use a bronze bushing that will just slip on the axle, or file out a piece of pipe or a fitting to a push-fit on it. Cut it a bit long and file to correct length by repeated trials.

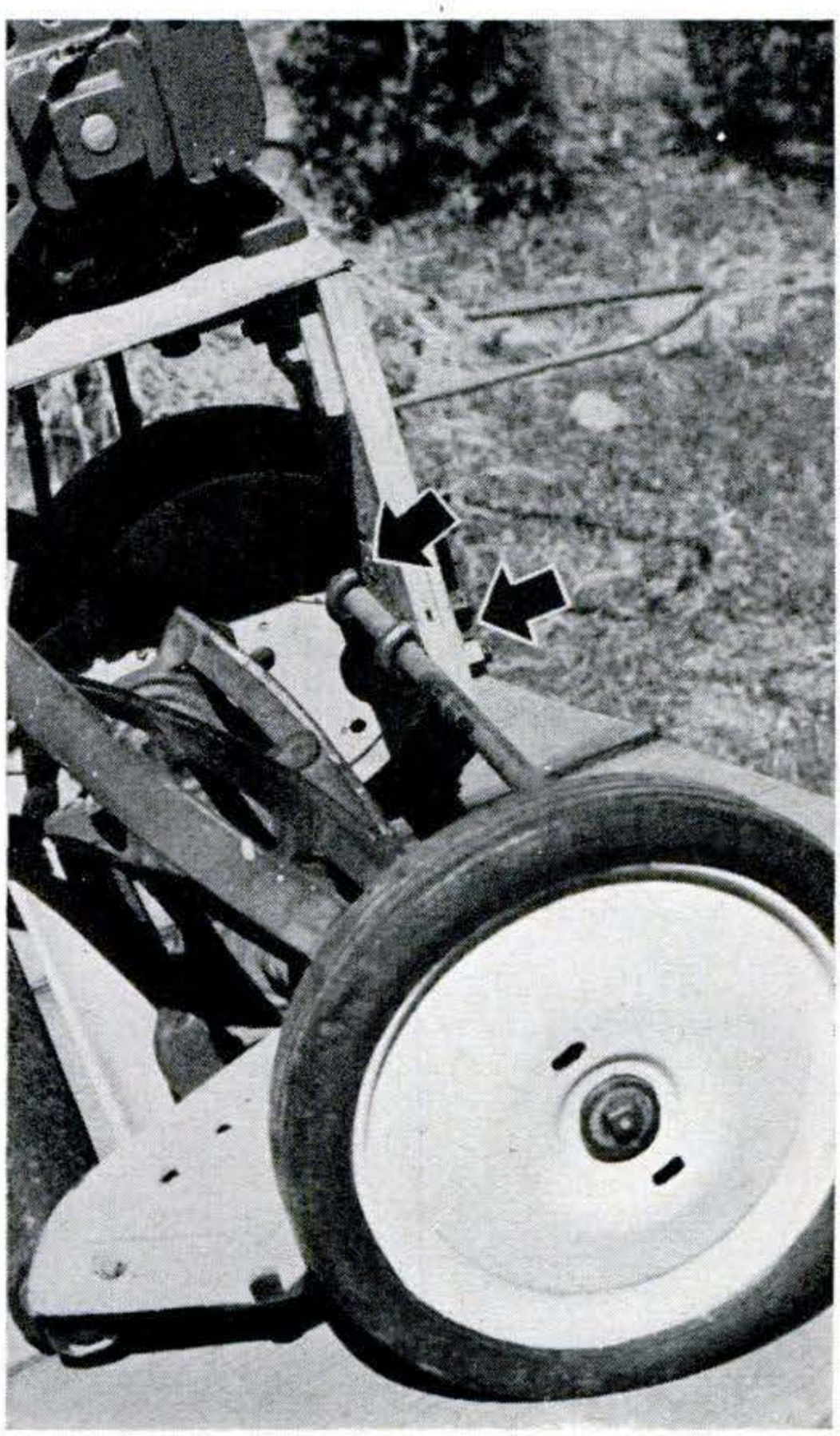
If the axle bolt were now pulled up tightly, it would pinch the wheel and keep it from turning. To prevent this, put a second spacer or a number of washers between the end of the axle and the head of the bolt. This spacer can be a loose fit in the wheel bearing. It should be just long enough to let the wheel turn freely.

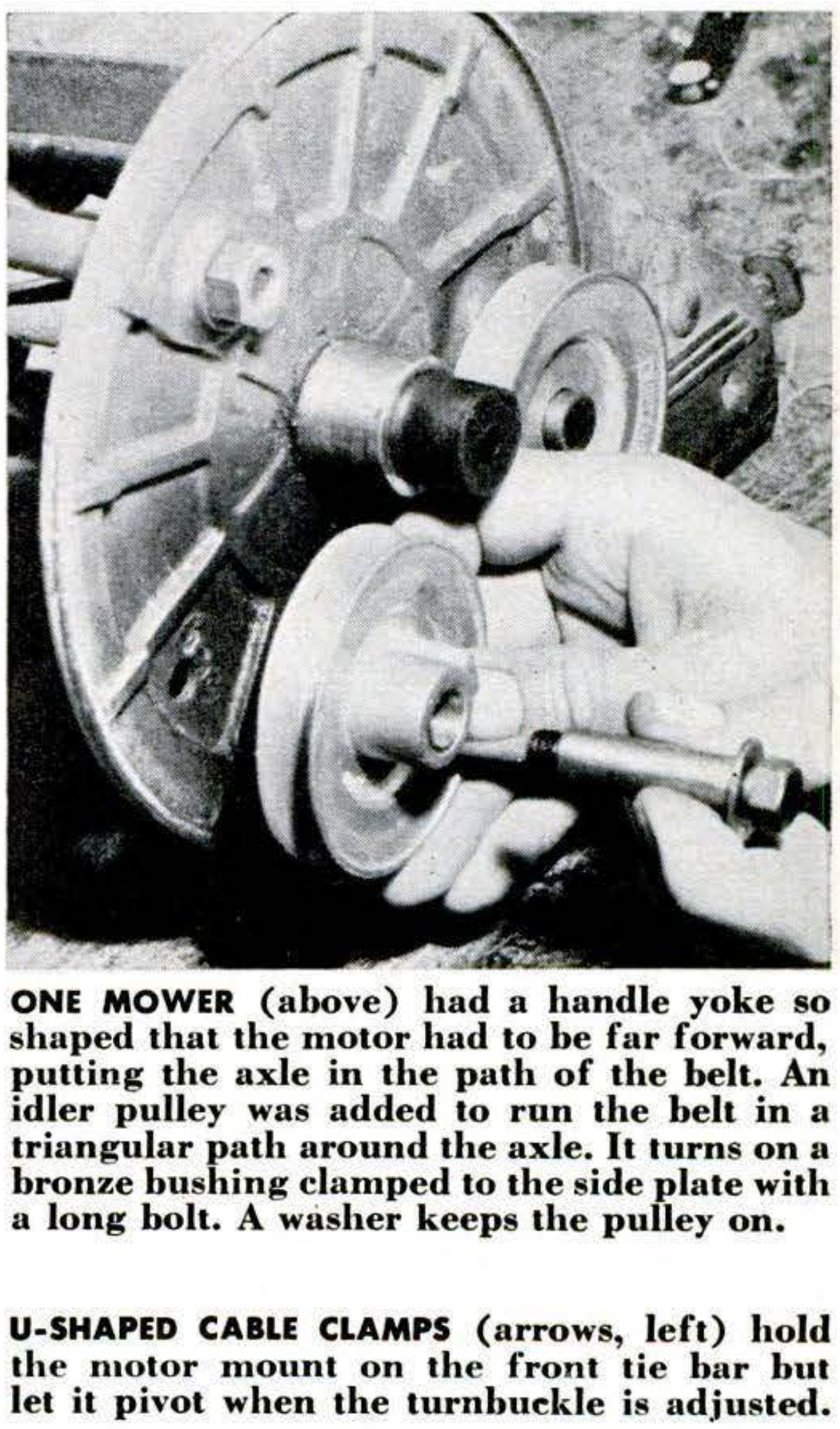
For good balance, the motor shaft should be almost directly above the reel pulley. Do not set it forward of the wheel axis or the rig will tend to tip forward. Make the motor mount of two pieces of ¾" exterior plywood, bolted together at right angles with a piece of heavy angle iron. Attach it to the front tie bar with two U-shaped cable clamps.

Under the free end of the motor shelf, bolt a short ½" steel rod extending beyond it on the pulley side. Slip one eye of a big turnbuckle on the rod. Bolt the bottom eye to the side plate of the mower, drilling the bolt hole in any convenient spot.

A 1½" motor pulley turning at 1,750 r.p.m. will run the reel at a suitable speed. Measure around both pulleys to determine belt length (probably between 33" and 40").

Run the motor cord up the handle to a switch. Attach enough heavy-duty, rubber-covered cord to reach all your lawn. END





ONE MOWER (above) had a handle yoke so shaped that the motor had to be far forward, putting the axle in the path of the belt. An idler pulley was added to run the belt in a triangular path around the axle. It turns on a bronze bushing clamped to the side plate with a long bolt. A washer keeps the pulley on.

U-SHAPED CABLE CLAMPS (arrows, left) hold the motor mount on the front tie bar but let it pivot when the turnbuckle is adjusted.

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Mesh Box Bottom Drains Water

LET loose in a sandbox, young diggers often try to reach China, mixing a lot of dirt with the clean play sand. But if you put a solid bottom on the box, rain water won't drain away, while a perforated sheet is likely to rot or rust. A simple solution is to tack a sheet of ½″ or ¼″ mesh screening across the bottom—it lets the water out but keeps the digger out of the dirt.—*E. Gaynor, Wantagh, N. Y.*

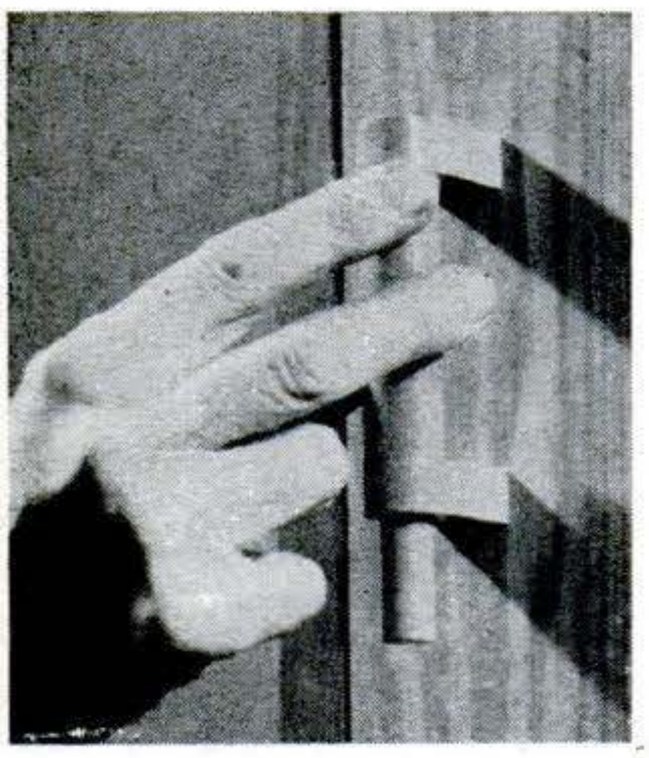
Snack Bar Serves Junior Miss

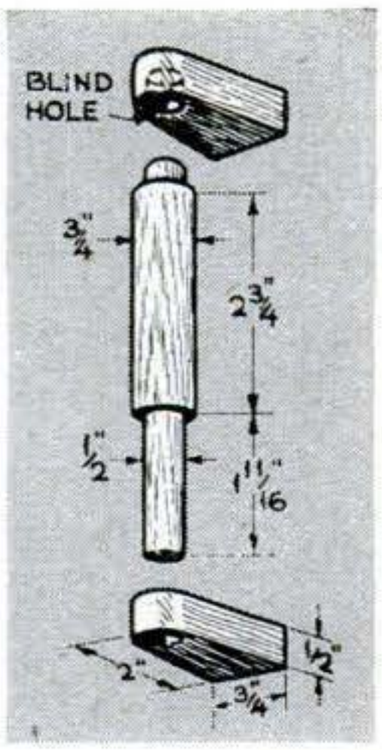
A LUNCH COUNTER built to small-fry size right in the kitchen not only delights the children but enables mother to feed them while going about other kitchen chores.

This one was made from a one-by-twelve 28″ long, with the corners rounded and the whole board sanded. It is hinged to the door about 18″ from the floor, and is supported by a 1″ dowel leg that fits into a hole drilled in the underside of the board.

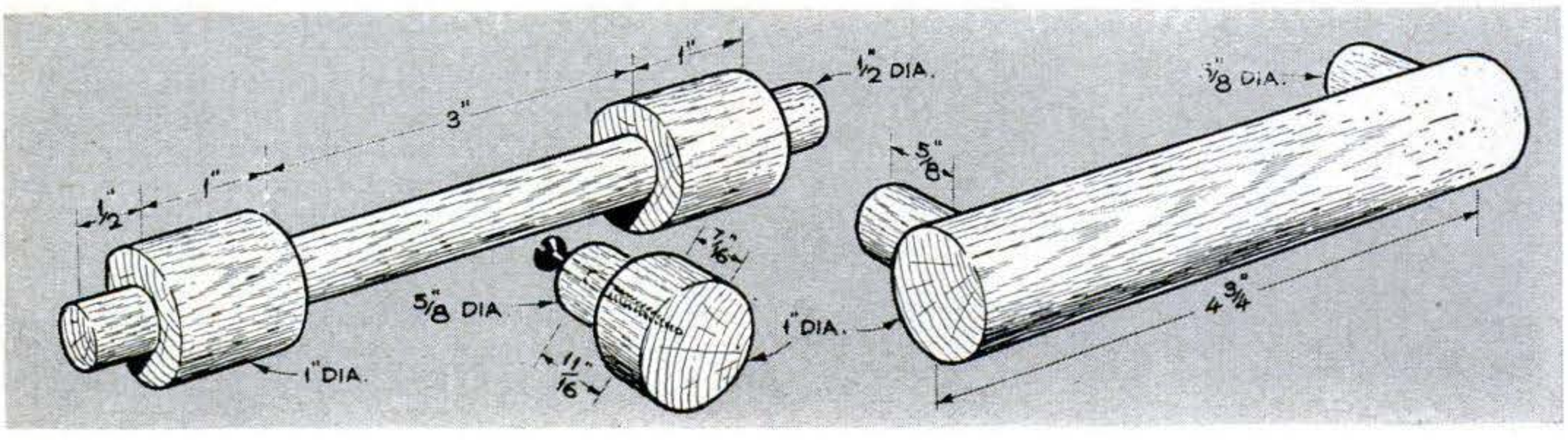
The bar folds up against the door, and is held by a loop of cord hooked over the doorknob. Slip the leg between shelf and door.—*Louis Alexander, Bellaire, Tex.*

Use Scraps of Doweling to Make Unusual Door Handles





ALL sorts of simple and attractive door and cabinet handles can be made from scrap lengths of dowels. The one at left, an unusual design suitable for vertical mounting, consists of a large dowel bored out to receive a smaller one. The two brackets are rounded to a matching radius and the handle installed with the "tail" down. Below are several other types made by combining various sizes of dowels. Screw the handles on from the inside of the door to conceal the screwheads.—*Walter E. Burton, Akron, Ohio.*



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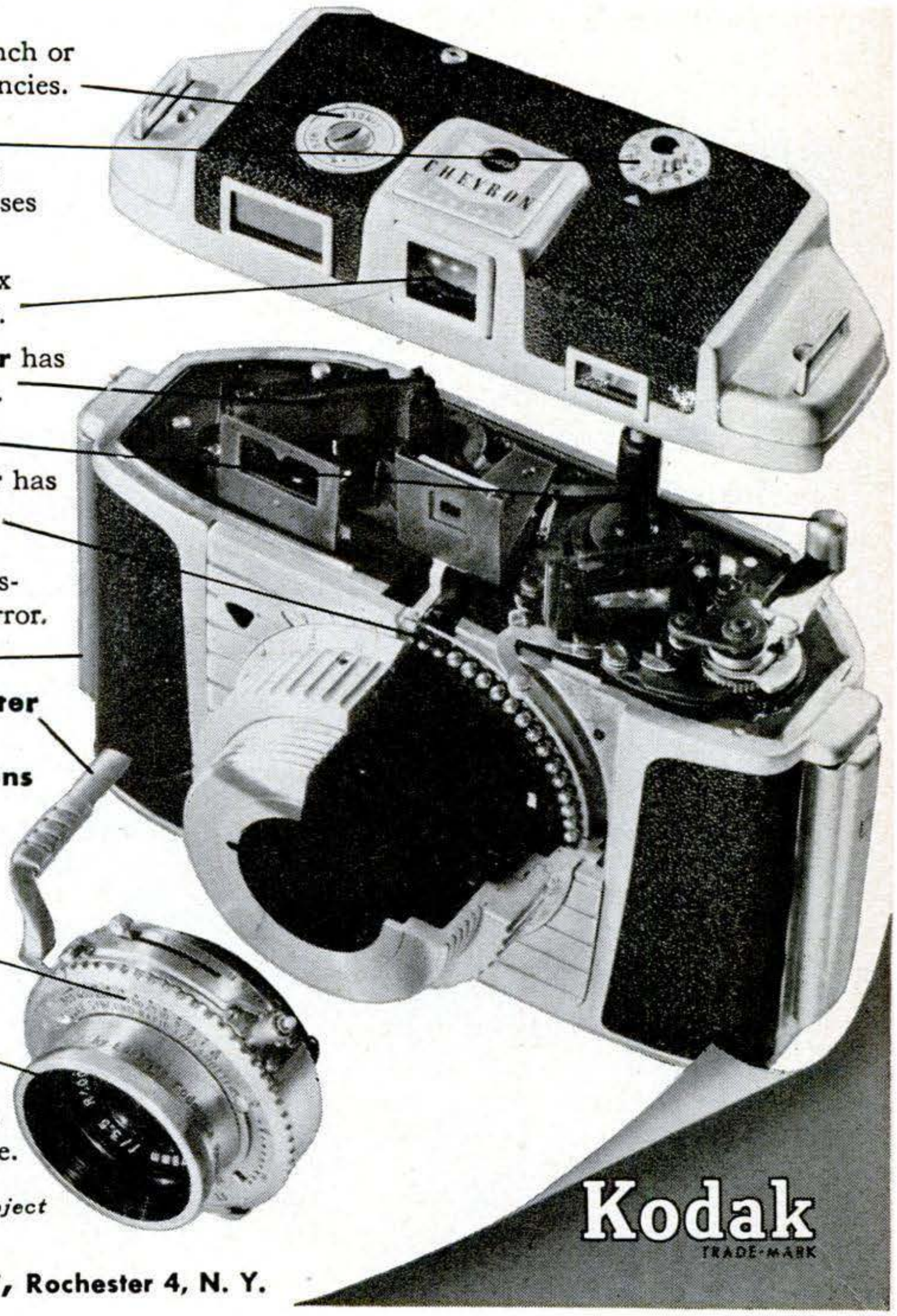
Here's the wonderful new Kodak CHEVRON Camera

Now, for the first time, Kodak's finest lens and fastest shutter in a precision 2¼x2¼ rangefinder camera

People kept asking: why doesn't Kodak combine the famous Ektar Lens, the Kodak Synchro-Rapid 800 Shutter, *plus* a coupled rangefinder, in a precision 2¼x2¼ roll-film camera? The Kodak Chevron Camera is it—a big camera, rugged, solidly balanced, designed for unsurpassed picture quality, trouble-free operation! And all at a sensible price—$215. See its many features in cutaway view below.



Viewfinder adjusts for 2¼x2¼-inch or 28x40mm. negatives and transparencies.

Automatic exposure counter.

Uses Kodak 620 Films, including Ektachrome and Kodacolor; also uses 828 film with adapter (extra).

Viewfinder has automatic parallax correction from 3½ feet to infinity.

Precision, split-field rangefinder has Vee bearings for focusing accuracy.

Handy thumb-lever film wind.

Tubular lens-and-shutter mount has ball-bearing action. Focusing ring rides on 56 ball bearings under constant pressure, for smooth focusing, with no "play" to introduce error.

Die-cast, all-metal body.

Convenient smooth-action shutter release.

World's fastest between-the-lens shutter—Kodak Synchro-Rapid 800. Ten speeds: 1 second to 1/800, plus "B". For flash, continuous time-delay from 2 to 22 milliseconds; X-F-M synchronization settings.

Kodak's finest lens—the Ektar 78mm. *f*/3.5—gives you needle-sharp negatives or transparencies for exceptional prints and enlargements—in color or black-and-white.

Price includes Federal Tax and is subject to change without notice

Eastman Kodak Company, Rochester 4, N. Y.

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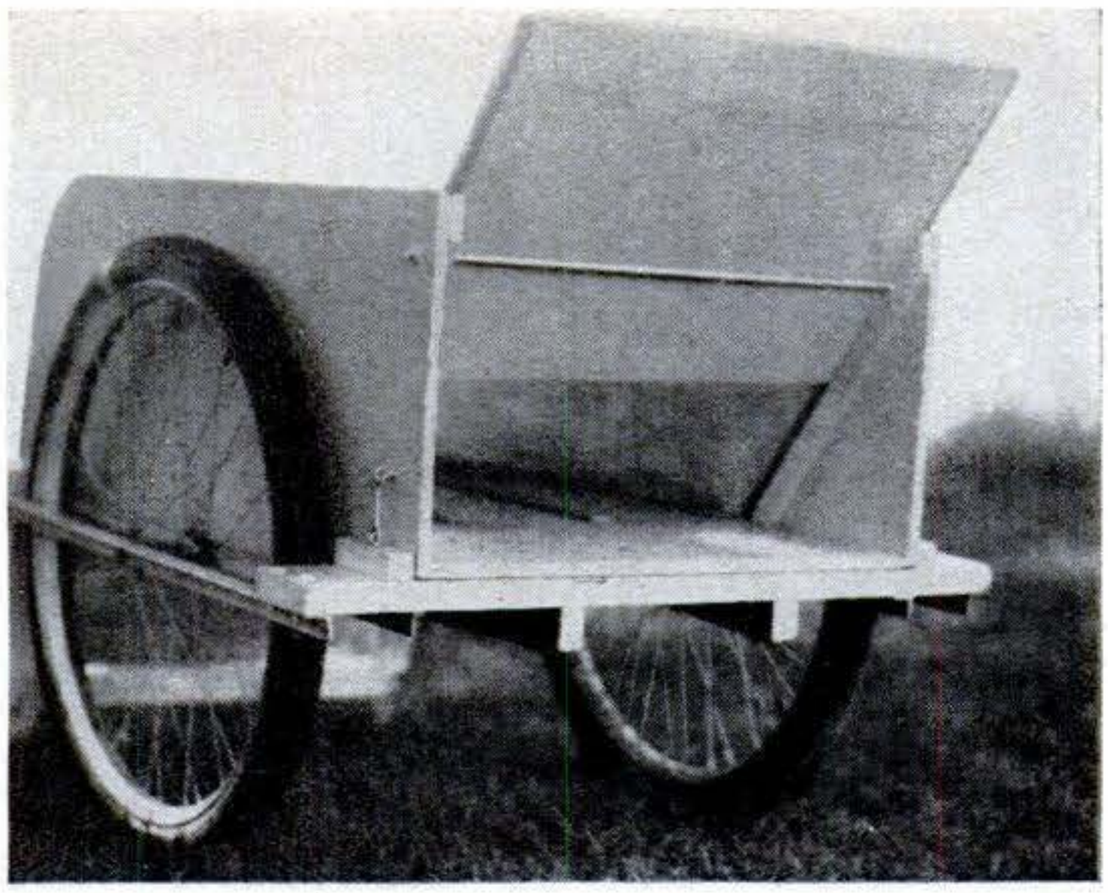
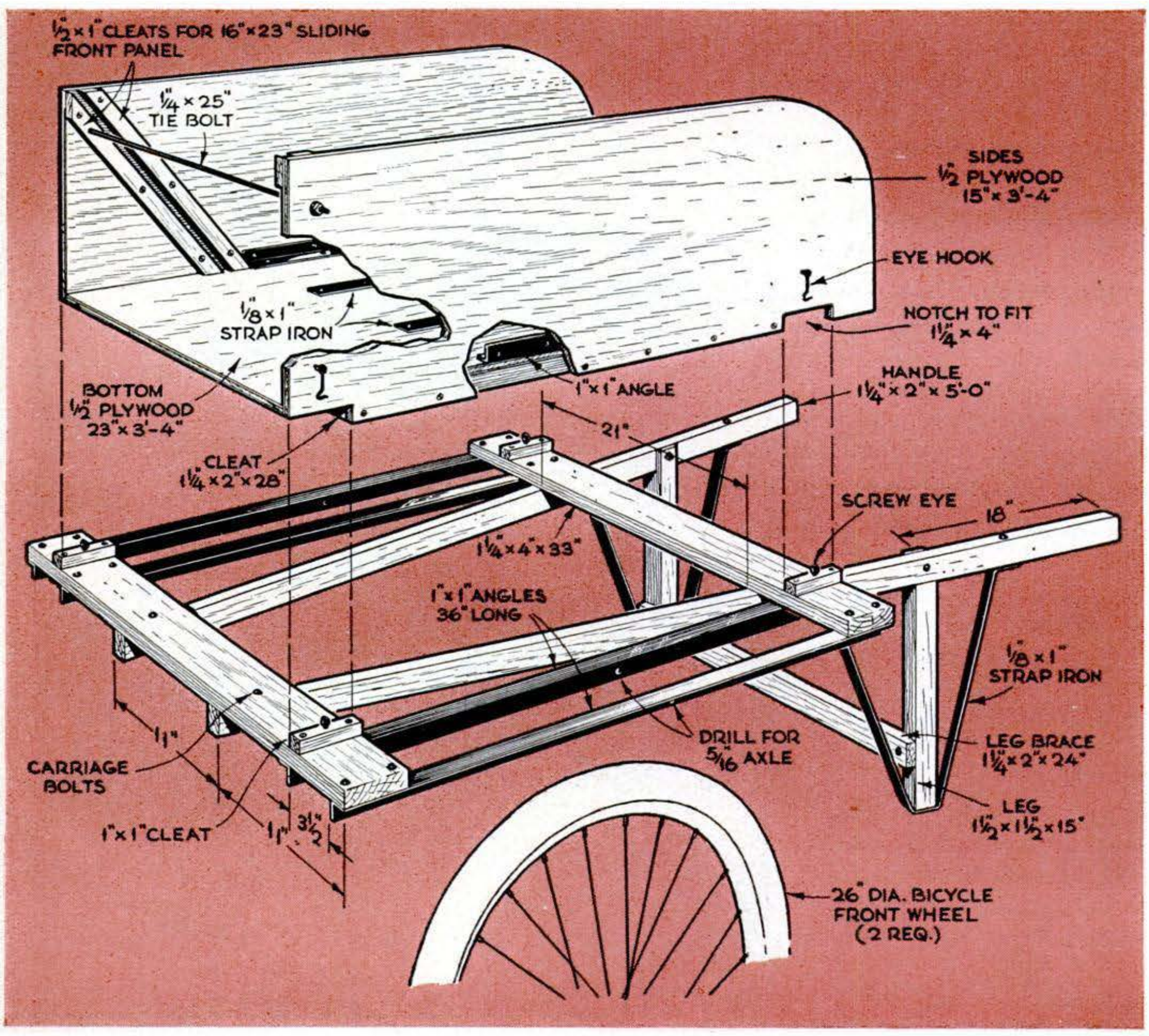
Convertible Wheelbarrow Eases Garden Chores



BICYCLE wheels make this wheelbarrow easy to roll over a lawn, even with loads up to 300 lb. The front panel slides up for dumping loose material. The body unhooks so the frame can be used alone for carrying pipe or lumber.

Angle iron adds strength to 1¼″ lumber to make a rigid, lightweight frame. The wheels turn on standard bike axles bolted between the two angles on each side of frame. At rest, two wood legs braced by 1″ strap iron support the outfit.

Three sides and a bottom of ½″ plywood are joined by 1¼″-by-2″ cleats and reinforced on the inside corners with angle iron. Iron strips strengthen and protect the floor. Two ½″-by-1″ cleats on each side hold the front panel in place and serve as guides for sliding it up for dumping. Sides are notched to fit over the cross members of the frame. Eye hooks on each corner lock into screw eyes on the frame to hold the body in place.—*W. M. Basch, Rumson, N. J.*



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Bright Ideas for Your SPRINGTIME SPRUCE-UP

"Liquid Aluminum"

Brushes or Sprays on Like Ordinary Paint . . . Gives Bright Protection to Your Home, Equipment, Do-It-Yourself Projects

Bring sunshine into your basement. Let *Liquid Aluminum* beautify gloomy walls, protect piping, ducts, furnace, wash tubs and other fixtures.

Touch up your valuable equipment . . . children's toys. Seal them against rust, moisture . . . with just one coat of wonderful *Liquid Aluminum*.

If you like to do-it-yourself . . . you can do it *better* with the help of *Liquid Aluminum*. You'll find 1001 uses for this amazing *metallic aluminum coating* that goes on just like ordinary paint. Made by leading paint manufacturers. Keep a can of *Liquid Aluminum* always on hand.

Finishing touch to your handicraft . . . a painted-on coating of *aluminum* beauty that makes things last years longer.

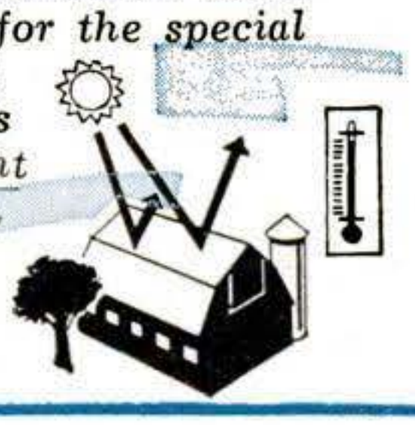
Guard your rustable chain-link fences, railings, incinerators, etc., with this gleaming *metal* coating that resists moisture, sun, heat.

Amazing Leafing Action

Protective beauty that *lasts years longer* is due to this unique "leafing action." Tiny flakes of aluminum rise to the surface as *Liquid Aluminum* dries to form a firm, tight coating of pure aluminum.

For "All-Purpose" Type, look for shining foil label at left.

***FOR ROOFS,** use heat-reflecting Liquid Aluminum with asphalt. Look for the special Warranty Seal that guarantees the right amount of aluminum in an approved vehicle.*



This advertisement appears in the interest of the Paint Industry of America

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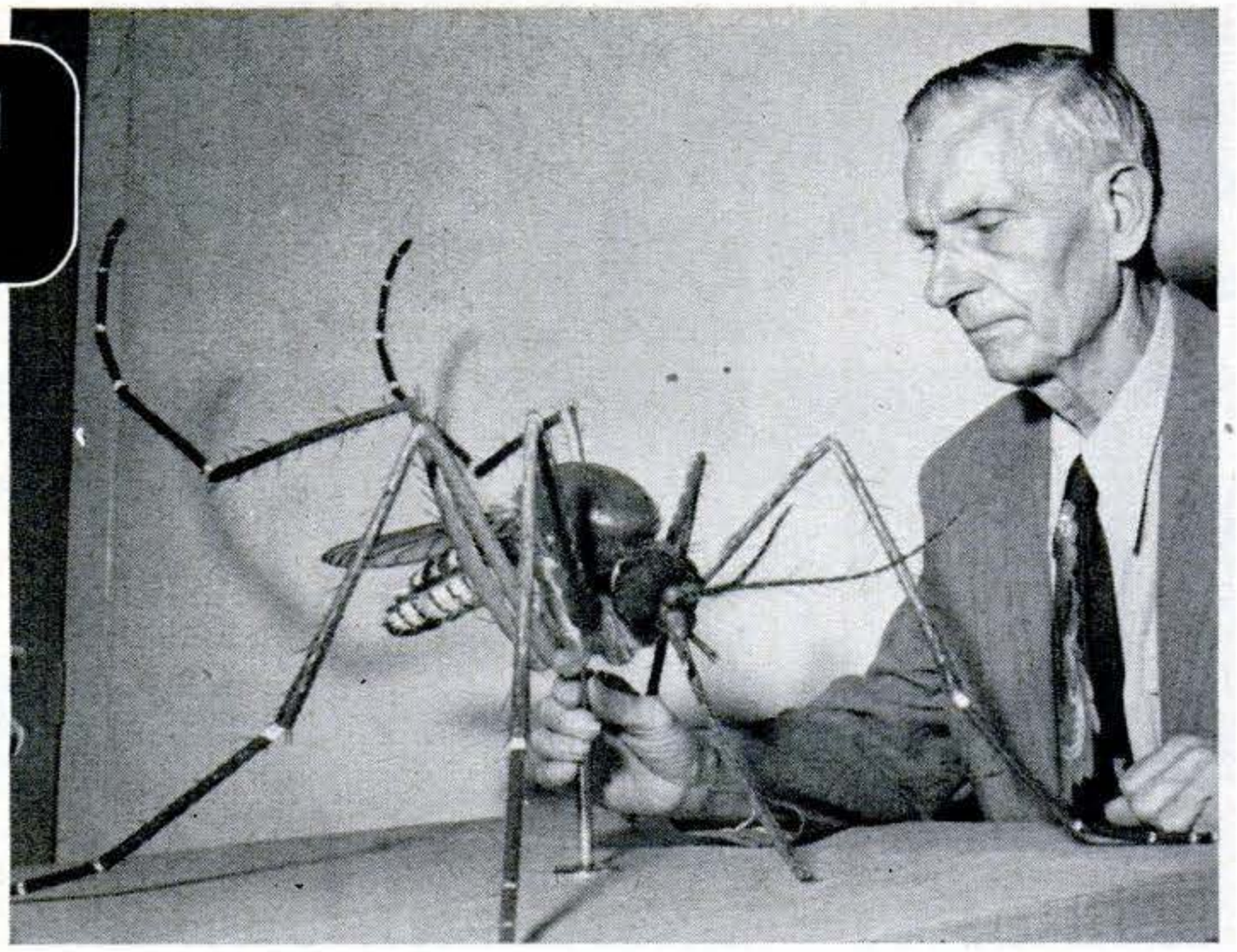
CRAFTSMEN AT WORK

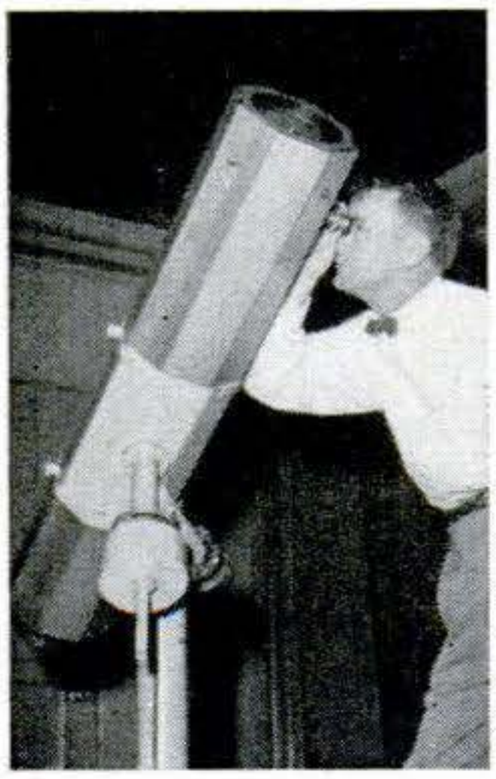


Big Buzzer. The 30-inch mosquito at right is probably the biggest in the world—enlarged 64 diameters over those you swatted last summer. Fortunately it exists only in plastic, steel, nickel and nylon. The huge model, made at home by Chris Olsen of West Nyack, N.Y., has more than 20,000 scales and spines. It is now in a Boston museum.

Auto Spring Powers Bow. The William Tell above is making the most of modern technology—his crossbow gets its zoom from the leaves of an auto spring. Eduard Breland of Laurel, Miss., built the bow. Since he was not using a tapered spring, Breland had the leaves ground down in order to get the bow to flex. The fittings are steel.

Junior Hot Rod Is Combo Job. This streamlined roadster was built from two scooters, a brace of 1940 Buick rear fenders and a German, two-cycle bicycle engine. The 4½-hp. engine provides a top speed of 18 m.p.h., but a governor holds junior drivers down to four: The car is equipped with clutch, brake pedals and foot accelerator. Sgt. John C. Stahlnecker, whose home is in DuBois, Pa., built the car for his son Eddie, shown above getting a ticket from an M.P. corporal. It cost the sergeant about $110, including professionally machined parts, and a week's spare-time work. He built it while stationed overseas.

Homemade Telescope Tracks Stars. Just like Palomar's Big Eye, the private eye below follows a star all night across the sky. Constant drive speed is obtained from a two-r.p.m. synchronous motor working through a tiny double universal gear, made of two fiber disks joined by a union. Using his home-workshop lathe, Dr. E.R.V. Anderson of Los Angeles turned the setting circles from tricycle wheels; the bearing tubes from double-thickness pipe.



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ACs with Patented *CORALOX* Insulator are Built for Both!

Waterproof Plug Automotive Plug

The waterproof spark plug developed by AC for the Ordnance Corps is as important to the performance of an amphibious military truck as the Snorkel tube which enables the engine to "breathe" under water. The insulator of these plugs is the same material as the insulator of AC plugs used in cars.

Both insulators are formed of patented *CORALOX*, the greatest spark plug development in 40 years. *CORALOX* is chemically resistant to the oxide deposits that result from the burning of leaded fuels. Being exceedingly strong, it permits the use of longer, thinner insulator tips which heat up rapidly to burn away oil and wet carbon deposits—the major causes of engine misfiring. That's why many car owners get—

- **A POWER INCREASE RANGING UP TO 10%**
- **FUEL SAVINGS OF AS MUCH AS ONE GALLON IN TEN**

when they change to new ACs with patented *CORALOX*.

ORIGINAL EQUIPMENT ON NEARLY AS MANY NEW CARS AS ALL OTHER MAKES COMBINED

AC SPARK PLUGS

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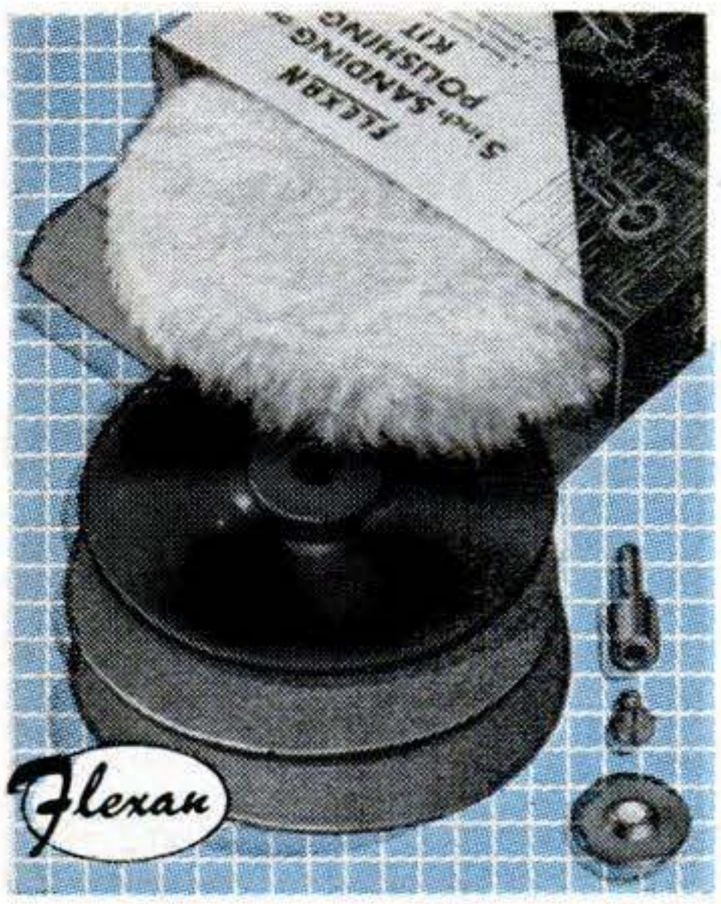
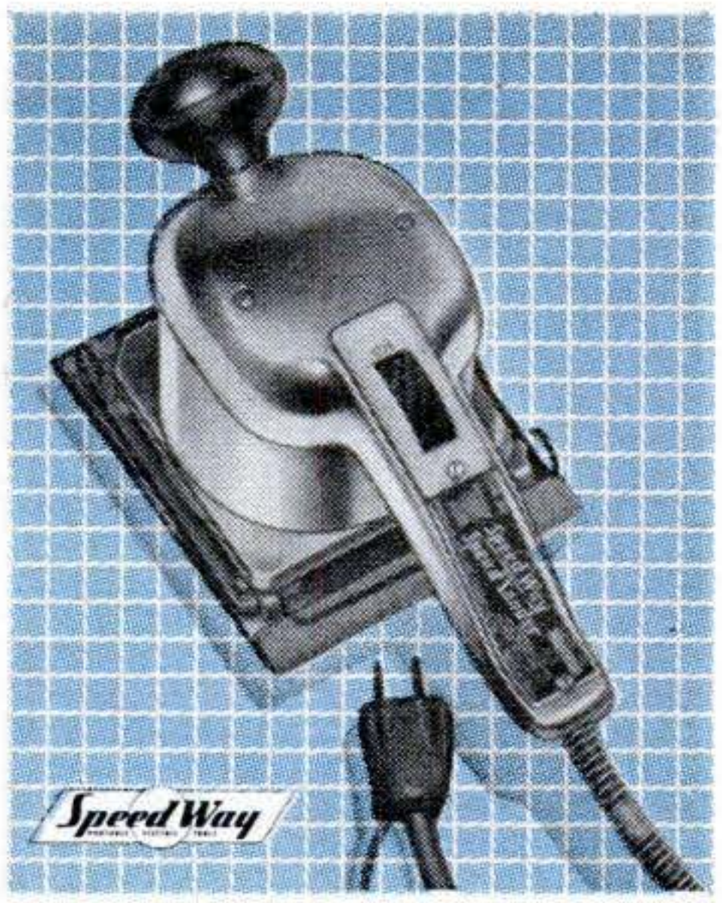
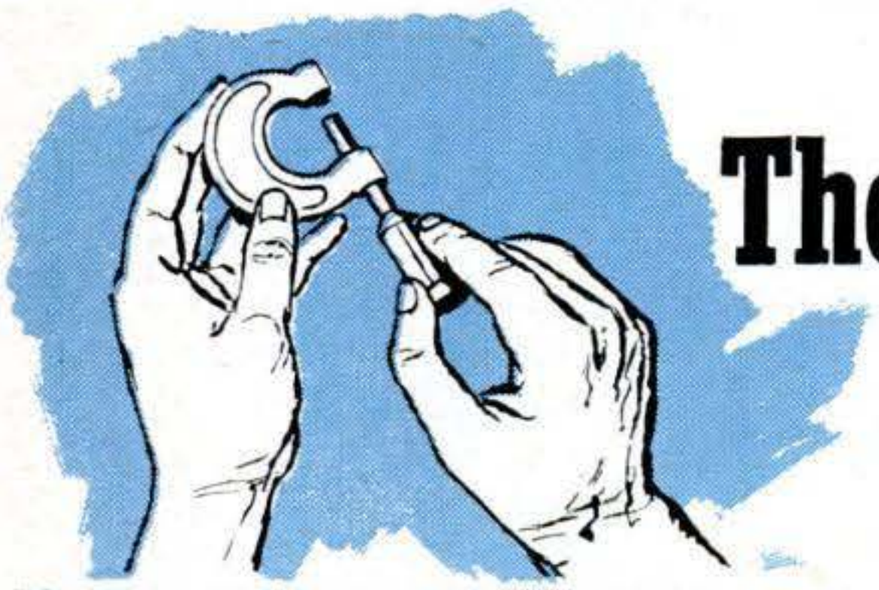


Everything for sanding, polishing. Flexan electric drill accessory kit includes: 4⅞″ flexible rubber disc, precision molded with metal insert; two 5″ aluminum oxide abrasive discs; 5½″ lambswool polishing bonnet; ¼″ shank for fitting to drill. (2HR2084) **$1.35**

Flick of the thumb makes this Wizard adjustable end wrench fit a wide range of nut, bolt sizes. Narrow tempered alloy - steel jaws. Deep-throat design. Twice as strong, yet 1/3 lighter! Chrome-plated head. 4″ to 15″ sizes. 8″ illus. (HR2402) **$2.19**



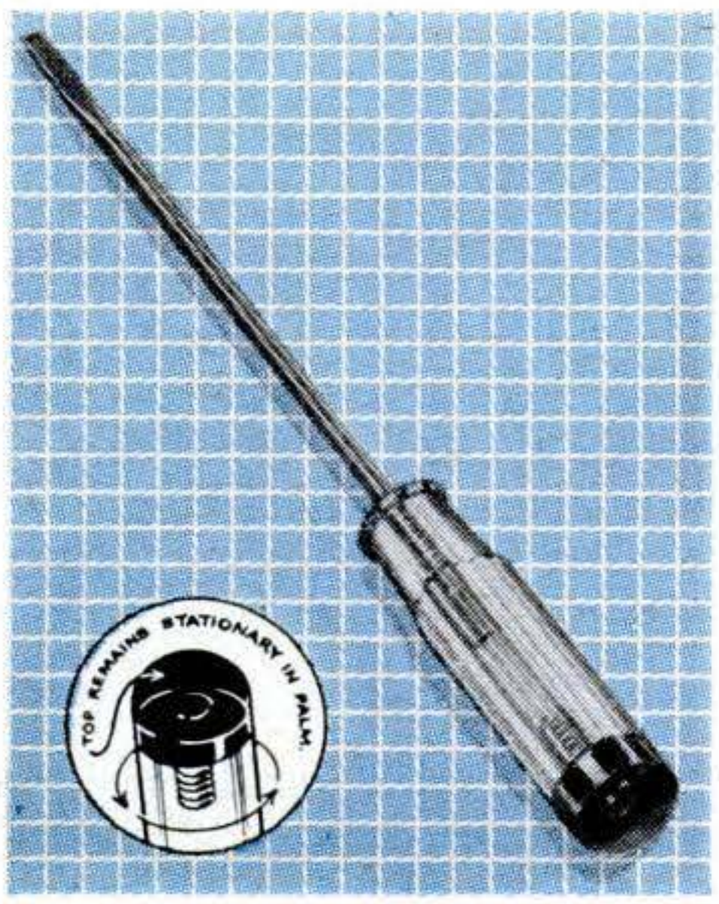
Ends tiresome hand sanding. Speedway Speedsander sands and polishes to "piano finish". 4½″ x5″ platen floats on 4 Neoprene balls . . . describes 3/16″ orbit 3,450 times a minute. Ball-bearing motor, direct drive. Cast aluminum body. (2HW1140) ..**$34.50**



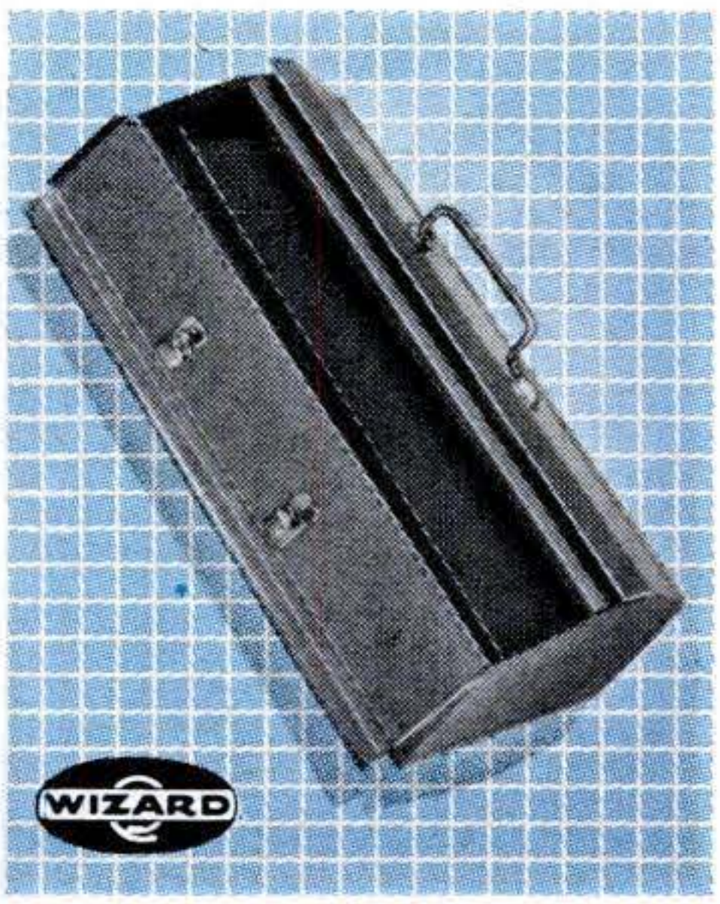
The Pick of America's Finest

Save time, save work . . . do it

Wizard bench saw blades, famous Cocker quality (96 yrs. experience). High carbon, chrome-nickel alloy steel. Highly polished, won't bind. ½″ or ⅝″ hole.
8″ Combination (2HR1022) **$2.49**
8″ Rip blade (2HR1023) **$2.49**
8″ Crosscut blade (2HR1024) **$2.49**



"Swivel-top" designed handle of fluted, firm - gripping Tenite makes this screwdriver practically blister - proof. Precision ground polished steel blade. Straight shank for deep countersunk screws. Cross-ground tip holds snug. Shockproof (HR1302) **.55c**



Built for heavy duty. Big 21″ Wizard tool box provides safe, convenient storage, easy carrying for dozens of tools. 24-gauge steel. Spot - welded joints. Hip-roof style with removable tote tray, tapered partitions. Double handles. (4HR4864) **$5.35**

Choose from over 1,100 professional quality power and

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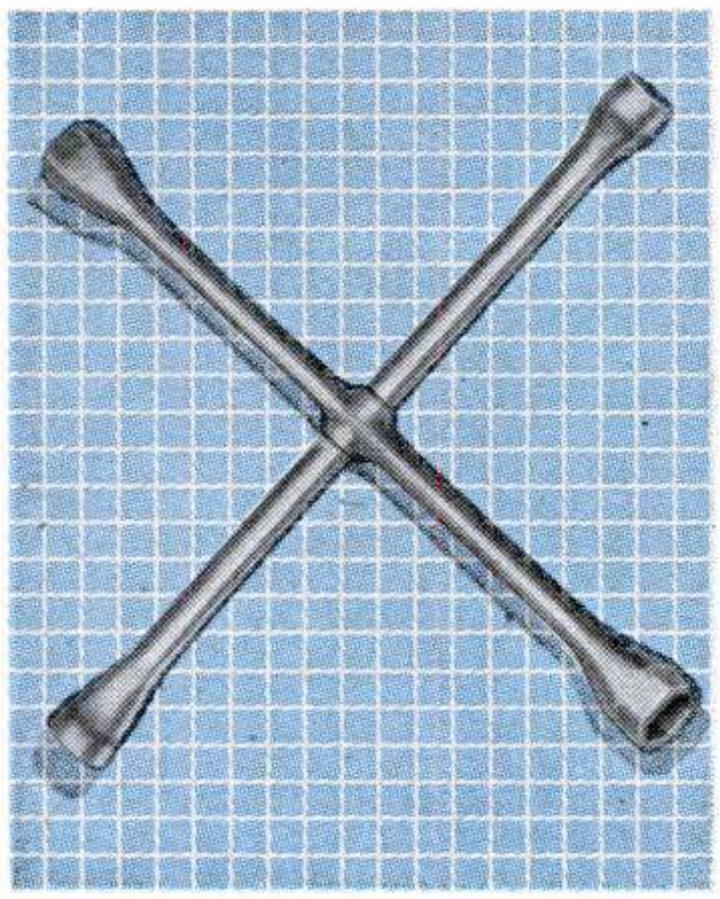
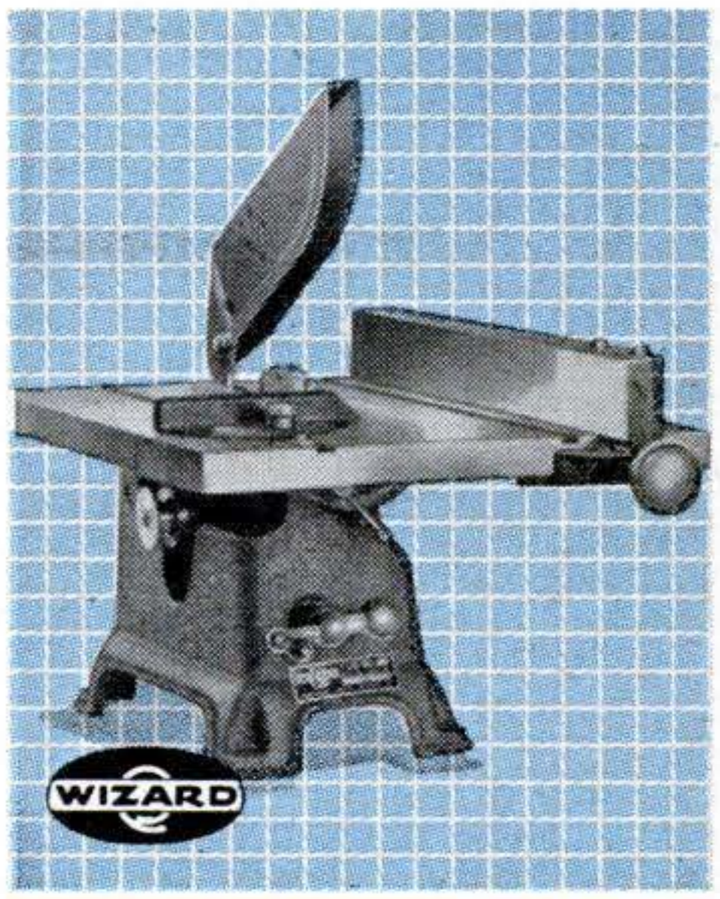
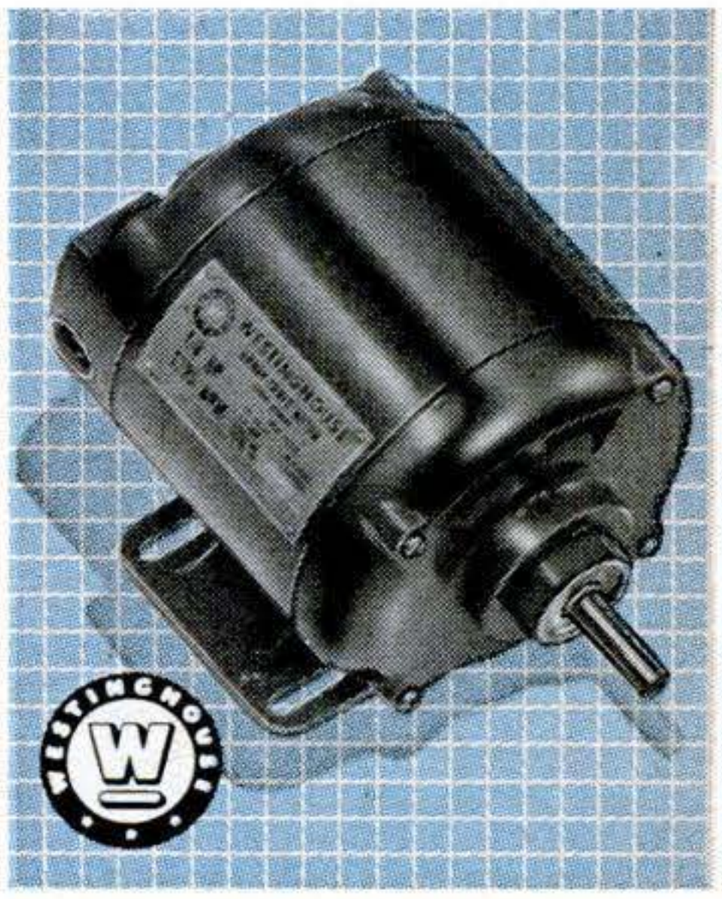


Change tires in a jiffy! Spinning action of 4-way rim wrench makes wheel nut removal quick, easy. 14" cross bars of forged carbon steel. Rust-resistant. Four deep sockets, size: 5/8", 3/4", 13/16", 7/8". Fits all passenger car wheel nuts. (4HR3755) ..... **.89c**



Makes woodworking easy. Wizard 8" bench saw rips, cross-cuts to 2¾" depth. 17¼"x14" cast iron table tilts 45° for bevel cuts. Heavy oilite bronze bearings. Dado capacity: 11/16" wide, 1¾" deep. Rip fence, miter gauge, comb. blade, guard. (2H1008) **$37.75**



Perfect power for tool grinders, power hacksaws, sprayers, etc. ¼ HP Westinghouse motor has long-life windings, sleeve bearings, nylon thrust washers, drip-proof brackets. 1725 rpm, 115 v, 60 cyc. AC. Split-phase. 1 yr. warranty. (2H1600) **$17.25**

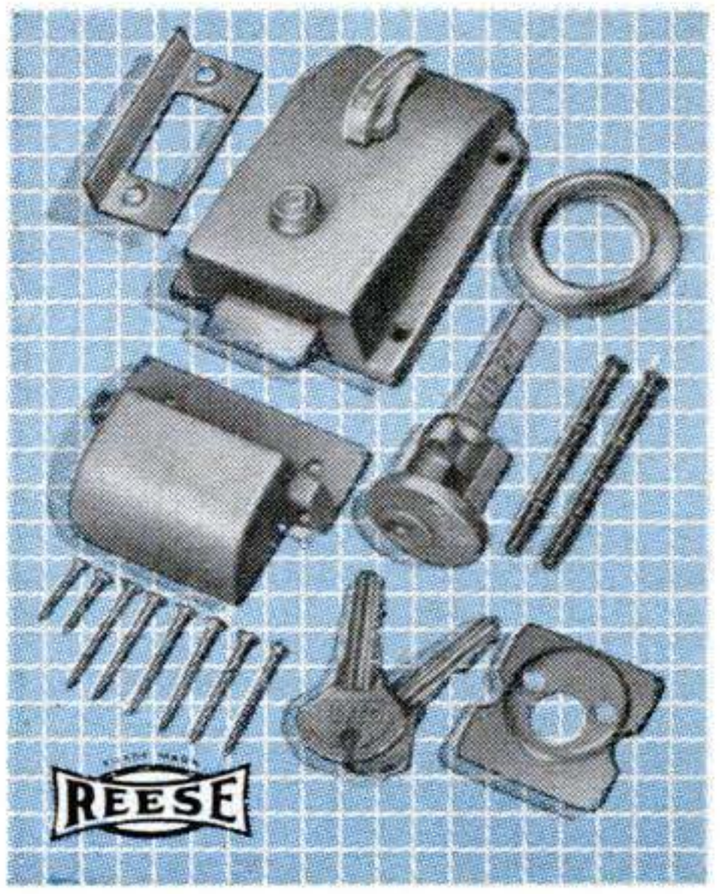
"Do it Yourself" Tools...at Western Auto

STORES AND ASSOCIATE STORES

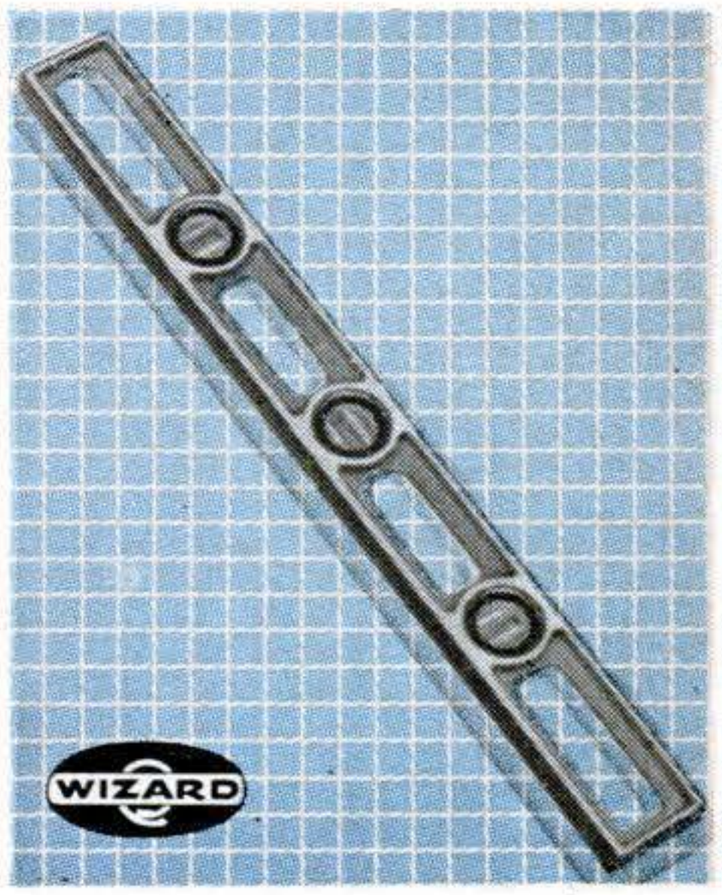
easier, faster, better...and save

NOTE: Western Auto Associate Dealers own their stores and set their own prices, terms and conditions. Prices may vary due to differences in local conditions. If you do not know the location of your nearest Western Auto Store write Western Auto Supply Co., 2107 Grand, Kansas City, Missouri. (PS44)

For top engine performance, make precision adjustments of pistons, spark plugs, tappets, etc. with this Westcraft thickness gauge. 15 blades (.002 to .025) of tempered steel. Polished to close tolerances. (4HR3189) ..... **.54c**
Others from..... **.22c** to **.94c**



Enjoy the extra protection of a Reese night latch. 5-pin tumbler mechanism with two strikes, reversible bolt. Mounts on either side of any door 1⅛" to 3" thick. Die-cast body with brass latch-lever permits one-hand operation. 2 keys. (3HS9920) **$2.95**



Lasting accuracy guaranteed. 24" Wizard lightweight aluminum level has patented setting compound in heavy protective lenses. Heat treated warp-proof casting with milled surfaces... can use in any position. Six-glass (4 plumbs, 2 levels). (4HR6579) **$5.19**

hand tools... see your Western Auto man this week.

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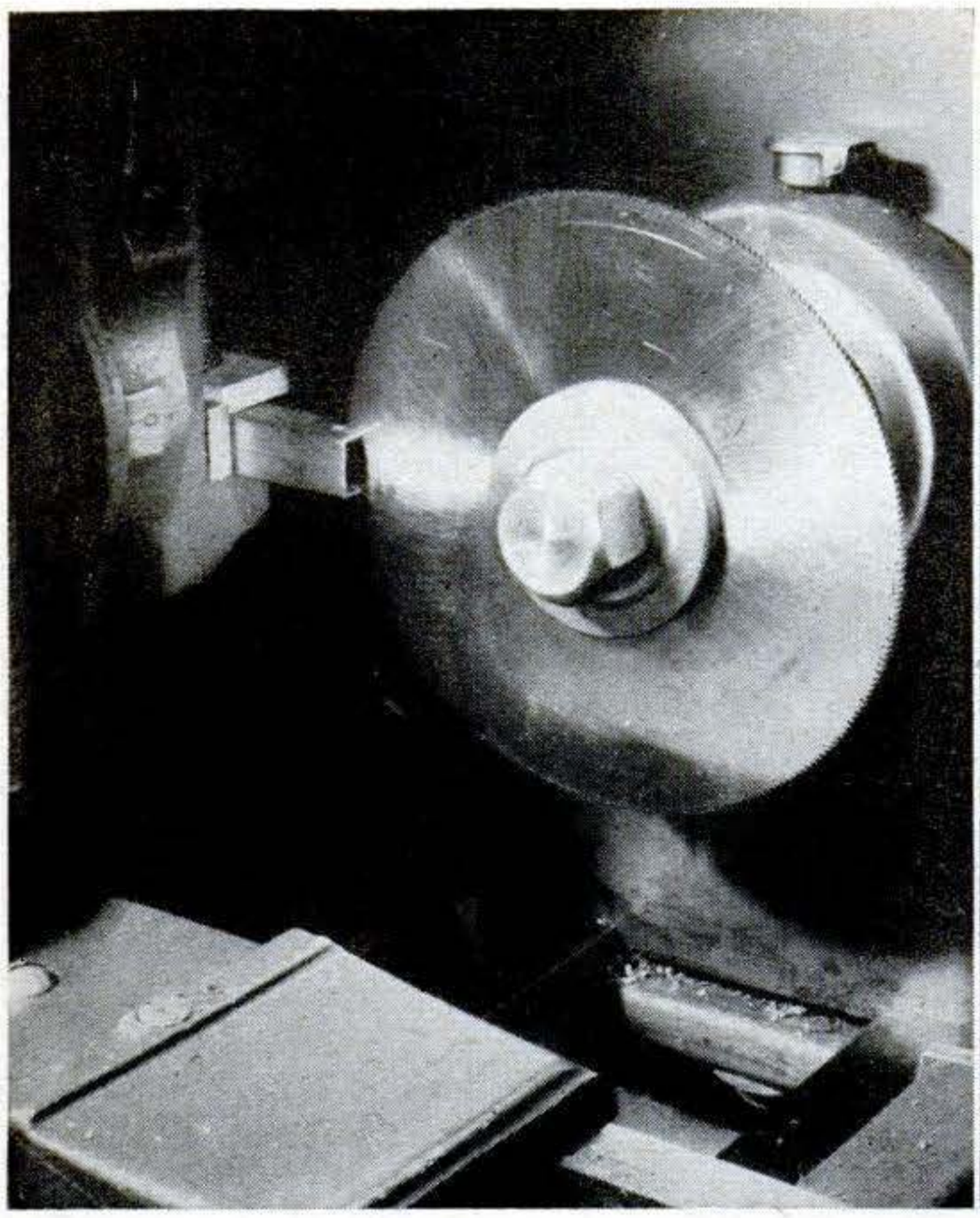
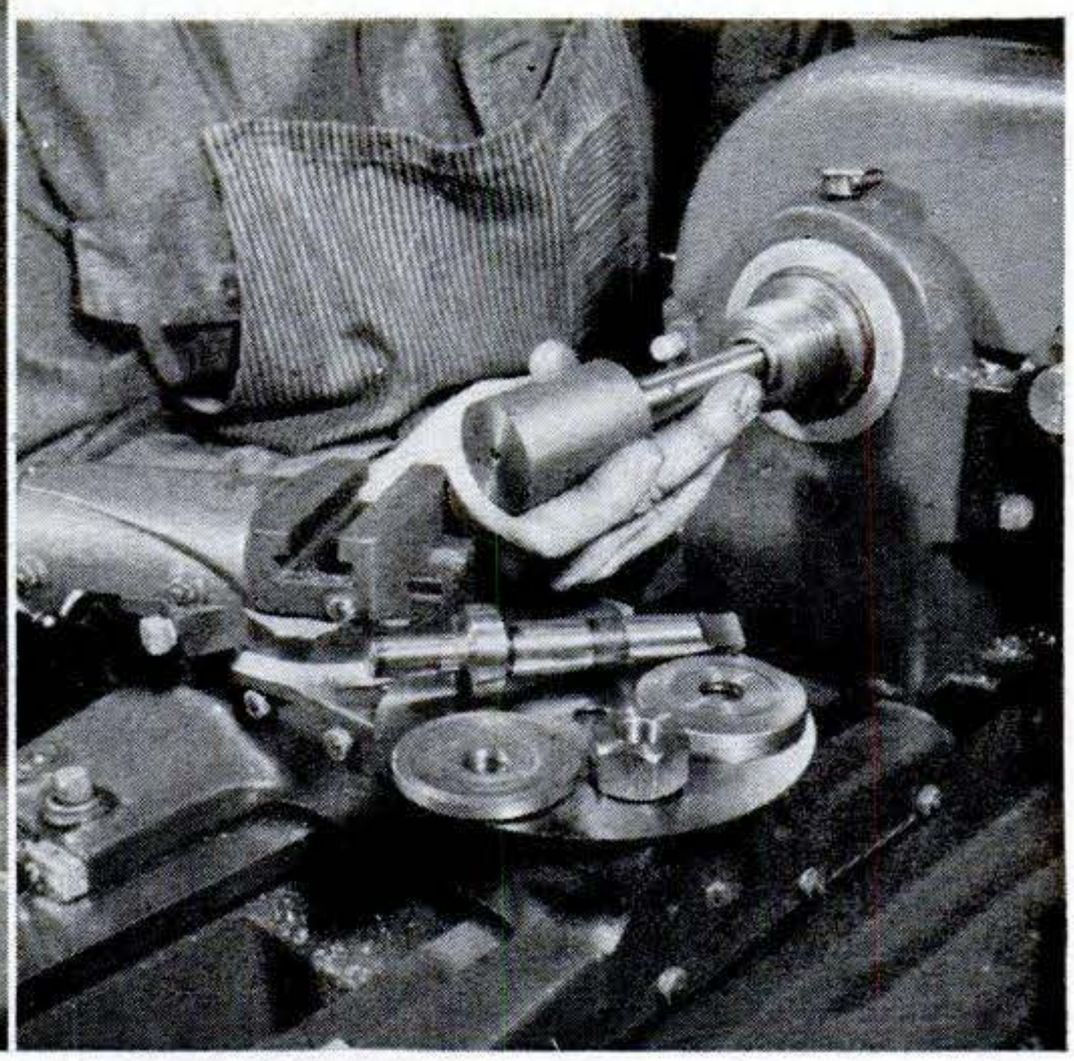
NEW Shop Ideas



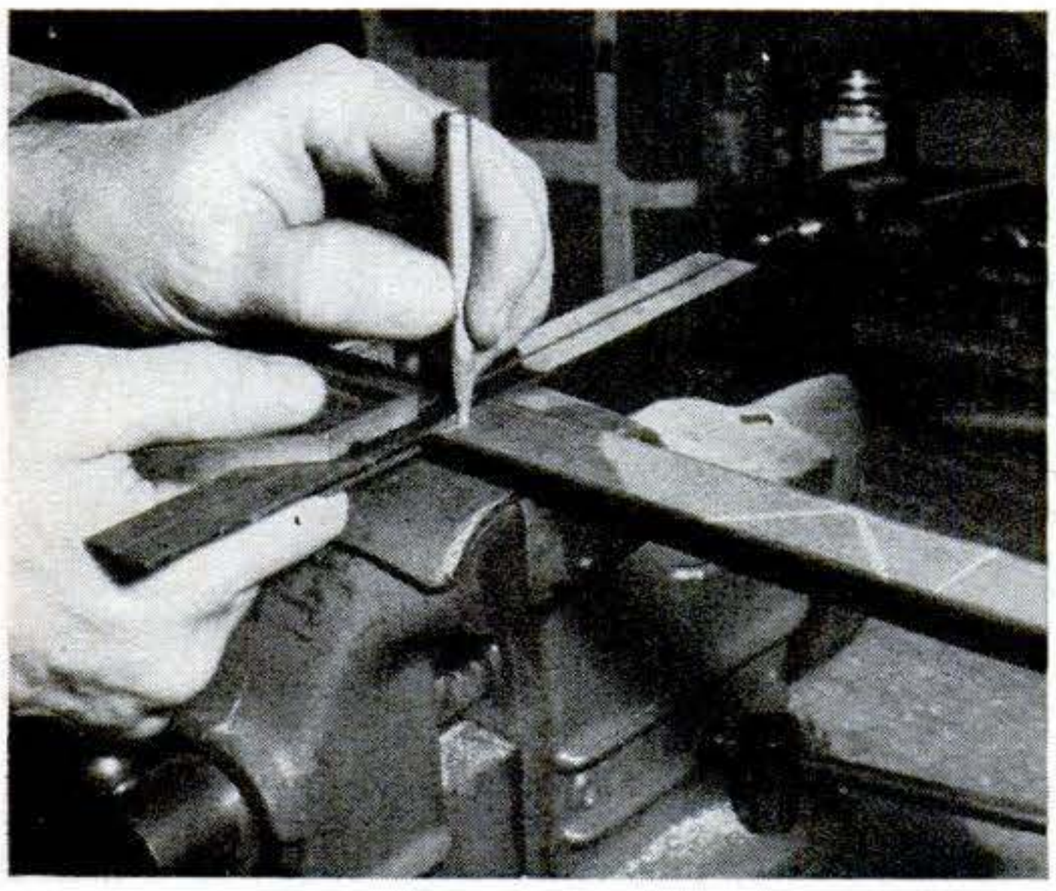


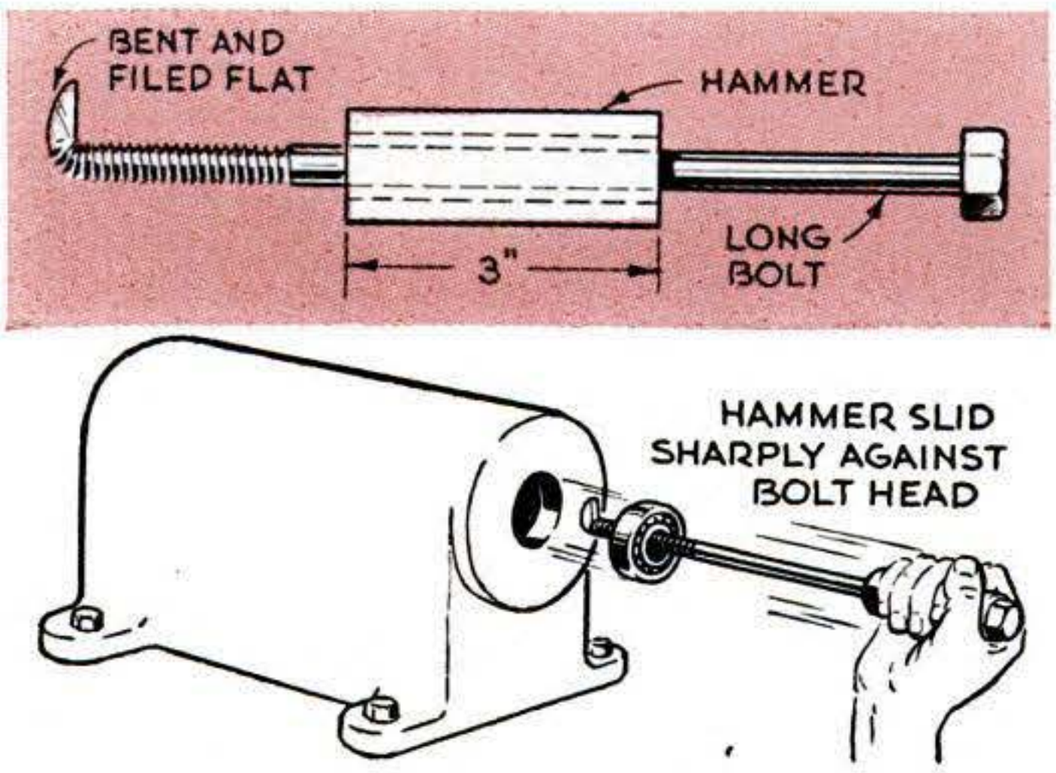
Chuck Arbor Holds Milling Cutters. Need a true-running arbor for a slitting saw or milling cutter? You can turn one from an inexpensive chuck-arbor blank obtainable at most tool shops. The blank comes with an accurately ground taper shank in sizes to fit most lathes.

Seat the blank firmly in the lathe and turn a shaft on the end to fit the cutters. Leave a shoulder on the arbor to bear against the clamping washers. Thread the shaft in the lathe and face the bearing surfaces of the lock nut and both washers on the arbor to eliminate wobble.

Punch witness marks on the lathe spindle, arbor and washers so that they can be used in the position in which they were made. —*Joseph Tracy, NYC.*

Silver Pencil Lays Out Welding. Use an art-store silver-lead pencil to mark steel plate and angle for cutting and welding. The silver lines are brighter and easier to see than ordinary pencil or scribed lines, and remain legible near welds as reference points for further assembly or machining.—*Howard McEntee, Ridgewood, N. J.*





Hooked Tool Pulls Bearings. Bearings or bushings that cannot be driven out from behind can be yanked out with this impact tool made from a long bolt. Make the hammer from a short piece of steel rod drilled to slide easily on the bolt. Slip it on the bolt, bend the bolt end over and trim the bend short with a hacksaw. File a flat on the bend to grip the bearings.—*L. Stadelbauer, Detroit, Mich.*

 Please turn to page 254 for more shop ideas.

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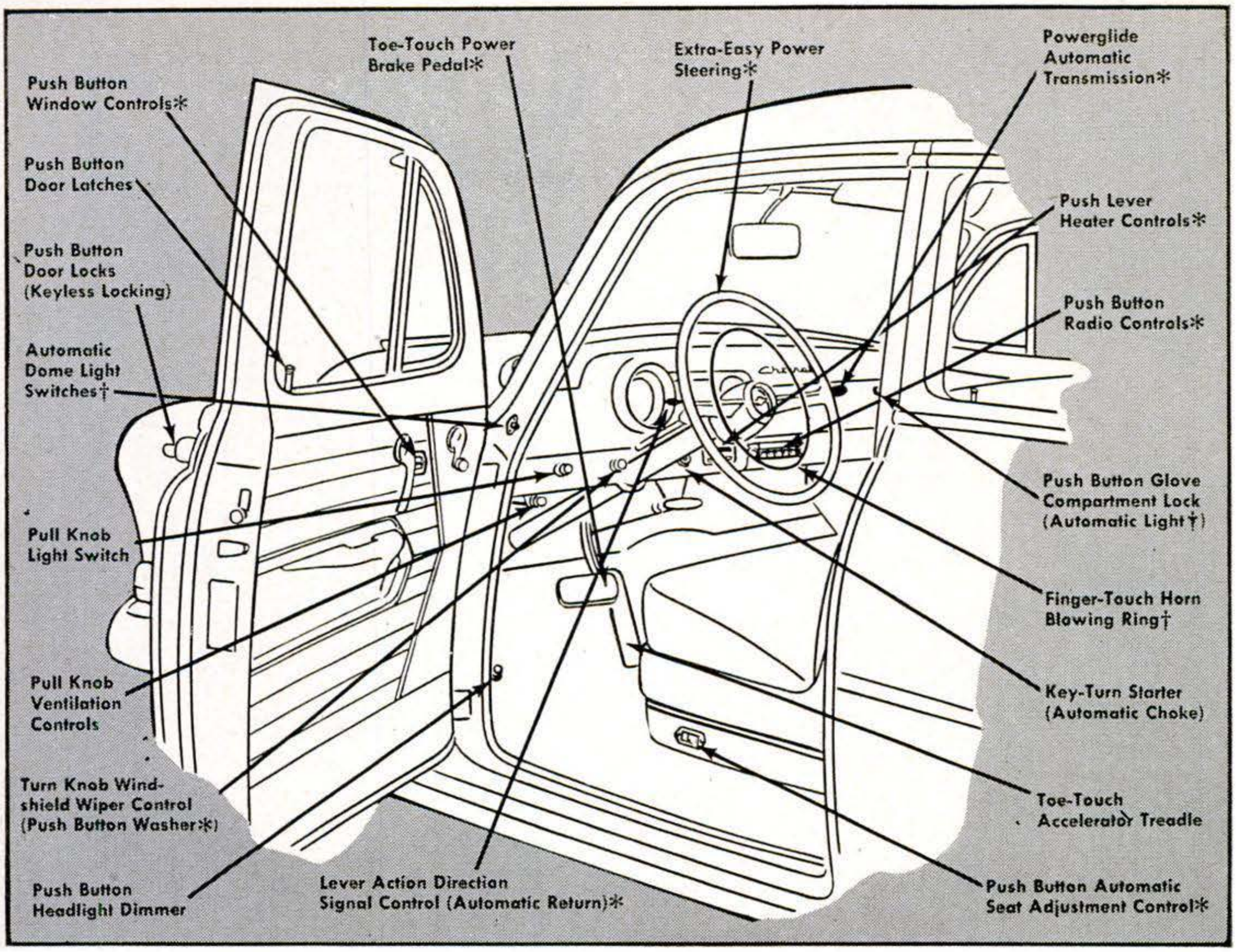
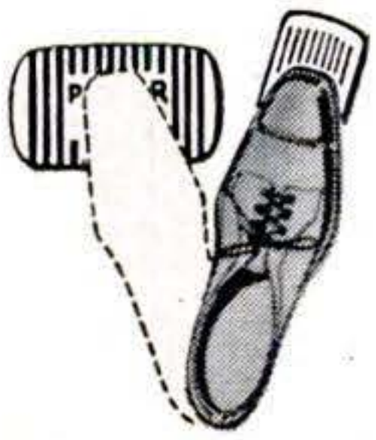


Advanced Chevrolet Engineering brings

THE CYBERNETIC CHEVROLET

(Cybernetic = Automatic Control)



Just a Swing of the Toe from "Go" to "Stop"

Cybernetics (sigh-bur-net'-ics)—the marvelous new science of automatic machines—lends its name well to the Cybernetic Chevrolet. Through more extensive use of automatic devices, Chevrolet now makes driving as automatic as you may wish it to be. Prompted by you through the simplest of motions—a touch of a finger or toe, an easy movement of your hand—these devices immediately and automatically respond to your will. With a touch on a button, an electric motor automatically moves the front seat to your most comfortable position. Front windows, too, adjust automatically to your command. While you're driving, the Powerglide transmission automatically selects the proper power ratio. At the go signal, its "automatic low" swiftly carries you ahead of traffic. Power Steering and Power Brakes automatically take the work out of parking and stopping. All these automatic advances now are yours, as extra-cost options, in the Cybernetic Chevrolet. See your Chevrolet dealer and try it. Find how much simpler, easier, and more enjoyable driving can be. . . . Chevrolet Division of General Motors, Detroit 2, Mich.

*Optional at extra cost. Power Brakes available on Powerglide models; automatic front window and seat controls on Bel Air and "Two-Ten" models. Windshield washer, direction signals, heater, and radio are accessories.
†Standard in Bel Air and "Two-Ten" models.

EVER FINER ENGINEERING — CHEVROLET — EVER FINER CHEVROLETS

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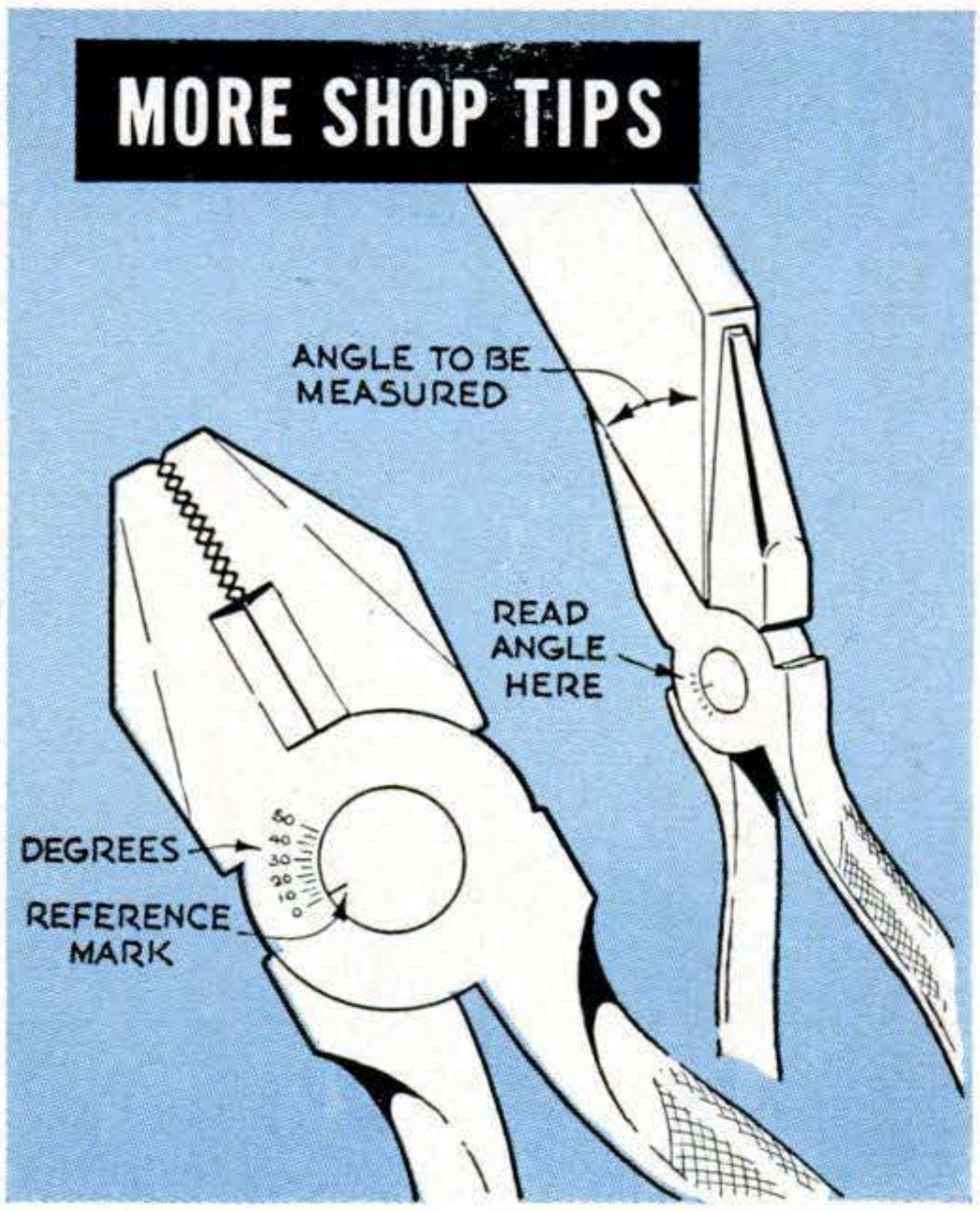
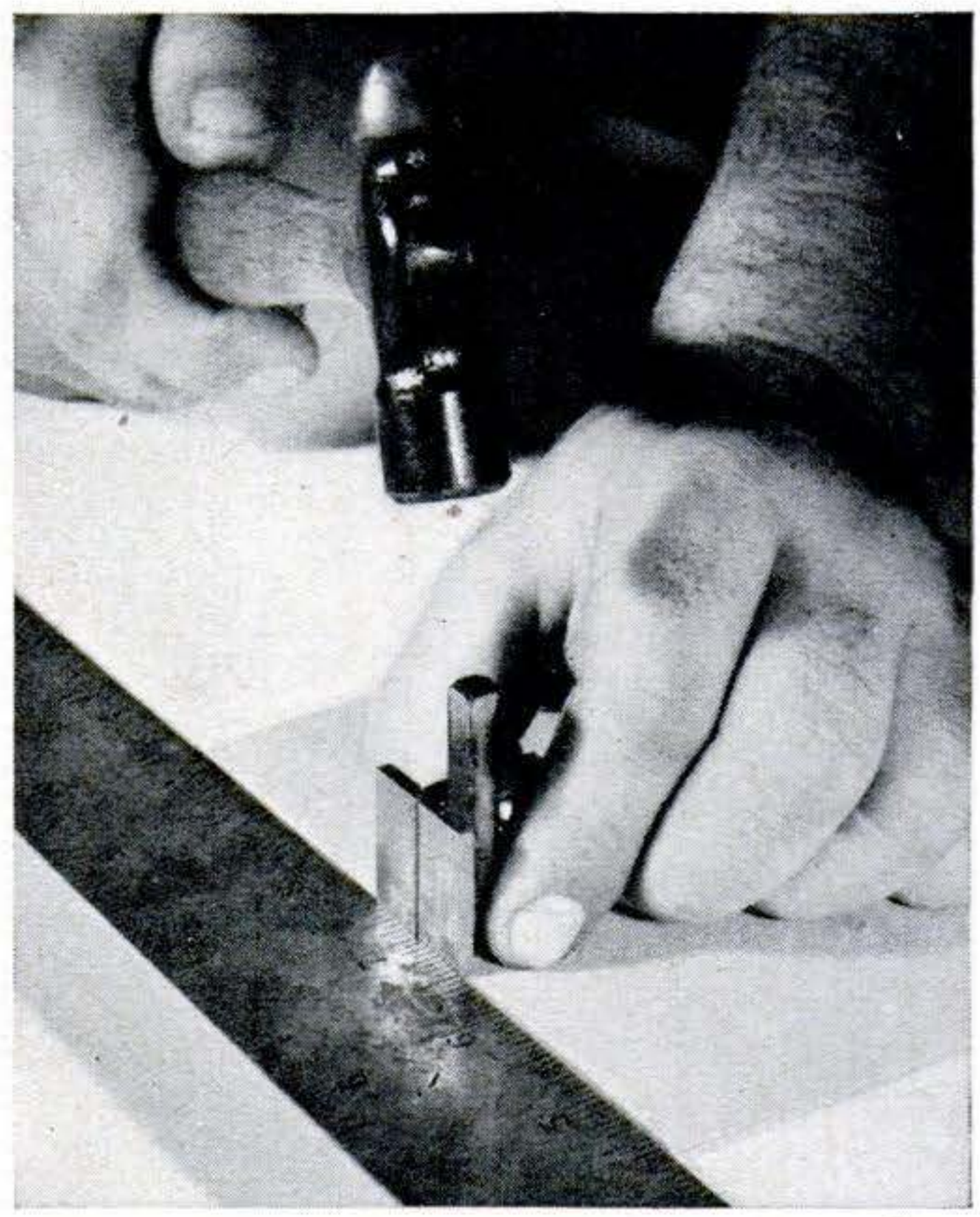
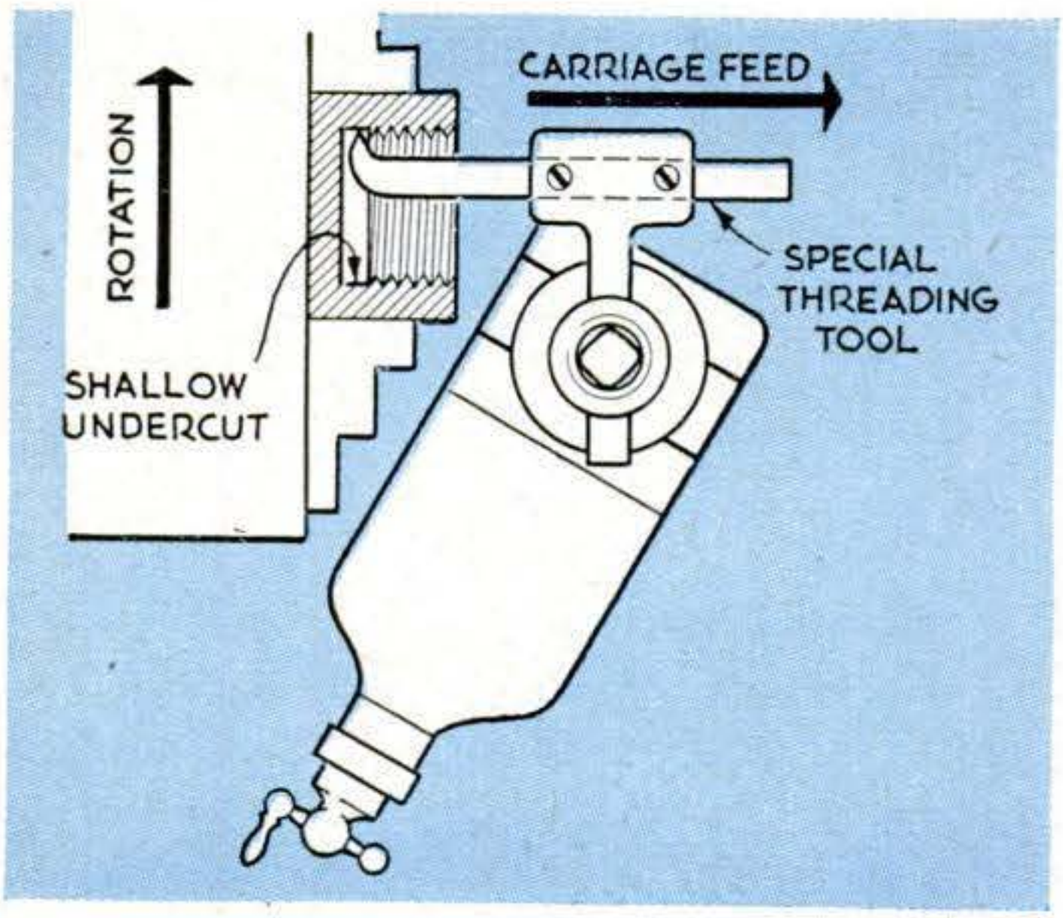
MORE SHOP TIPS



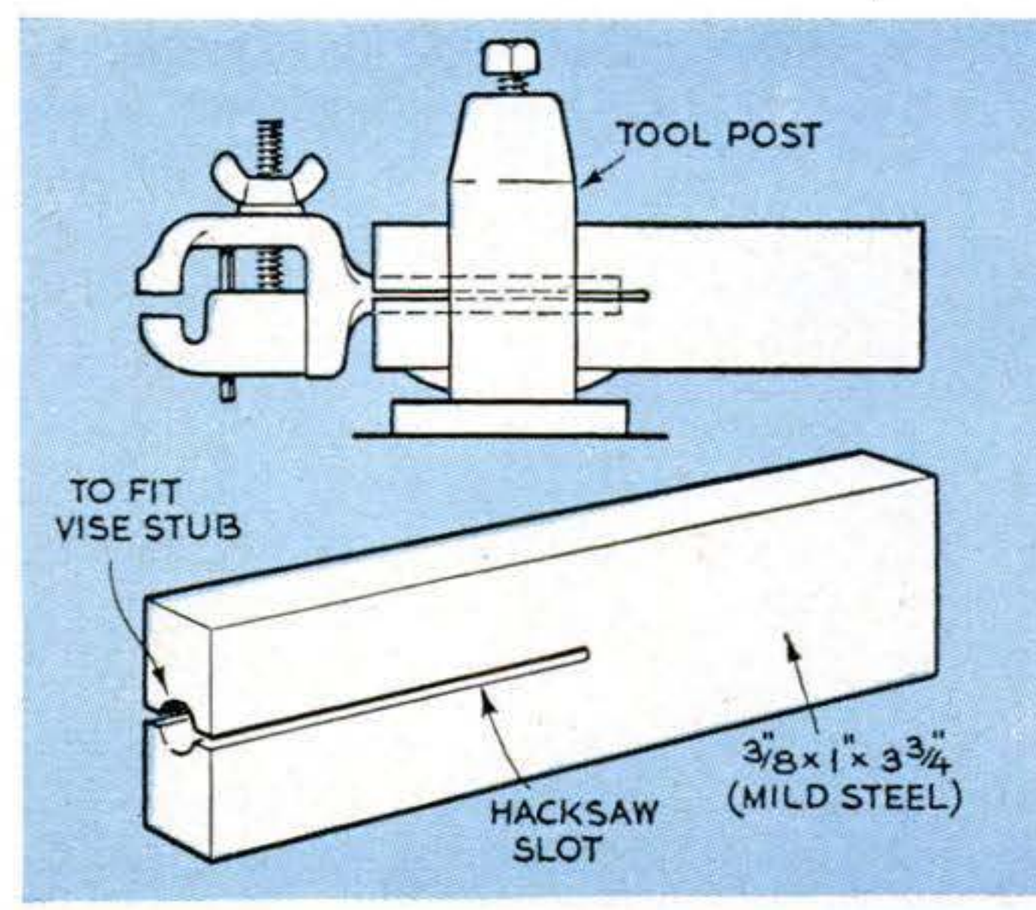
Pliers Check Angles. You can quickly rough-check angles with a pair of pliers graduated in degrees. Cut degree marks on the hub and an index line on one jaw with a thin punch or vibrating engraving tool. To use, grip the work between the jaws so that the jaws line up with the angle of the work.—*Pvt. P. E. McCafferty, Fort Bliss, Tex.*



Angles Guide Letterpunches. Two short pieces of steel angle riveted back to back will support letter and number punches vertically for making even indentations. The joint between the angles can be used as a guide line for spacing out the letters against a machinist's rule or for setting them evenly along the edge of a workpiece.



Thread Blind Holes Safely. Avoid jamming a tool bit into the bottom of a blind hole by cutting threads with the lathe in reverse. Grind a threading tool to work *behind* the lathe centerline and set the carriage to feed from left to right. Advance the tool into the bore with the manual feed, then engage the half-nut lever according to the marks on the lead-screw dial as when threading from right to left.



Hand Vise Used in Lathe. Grip jointer blades, lathe tool bits or small workpieces in this vise to pass them accurately over a grinding wheel mounted in the lathe headstock. The vise, a small hand vise with the handle removed, is clamped in a steel block cut to fit the tool post. The stub is inserted in a slotted hole in the block, and pressure of the tool-post bolt locks it at any desired angle.—*F. H. Louden, Sarasota, Fla.*

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Her kitchen is really her workshop. She takes pride in it, too—*when it's easy to clean up* after food preparation or dishwashing.

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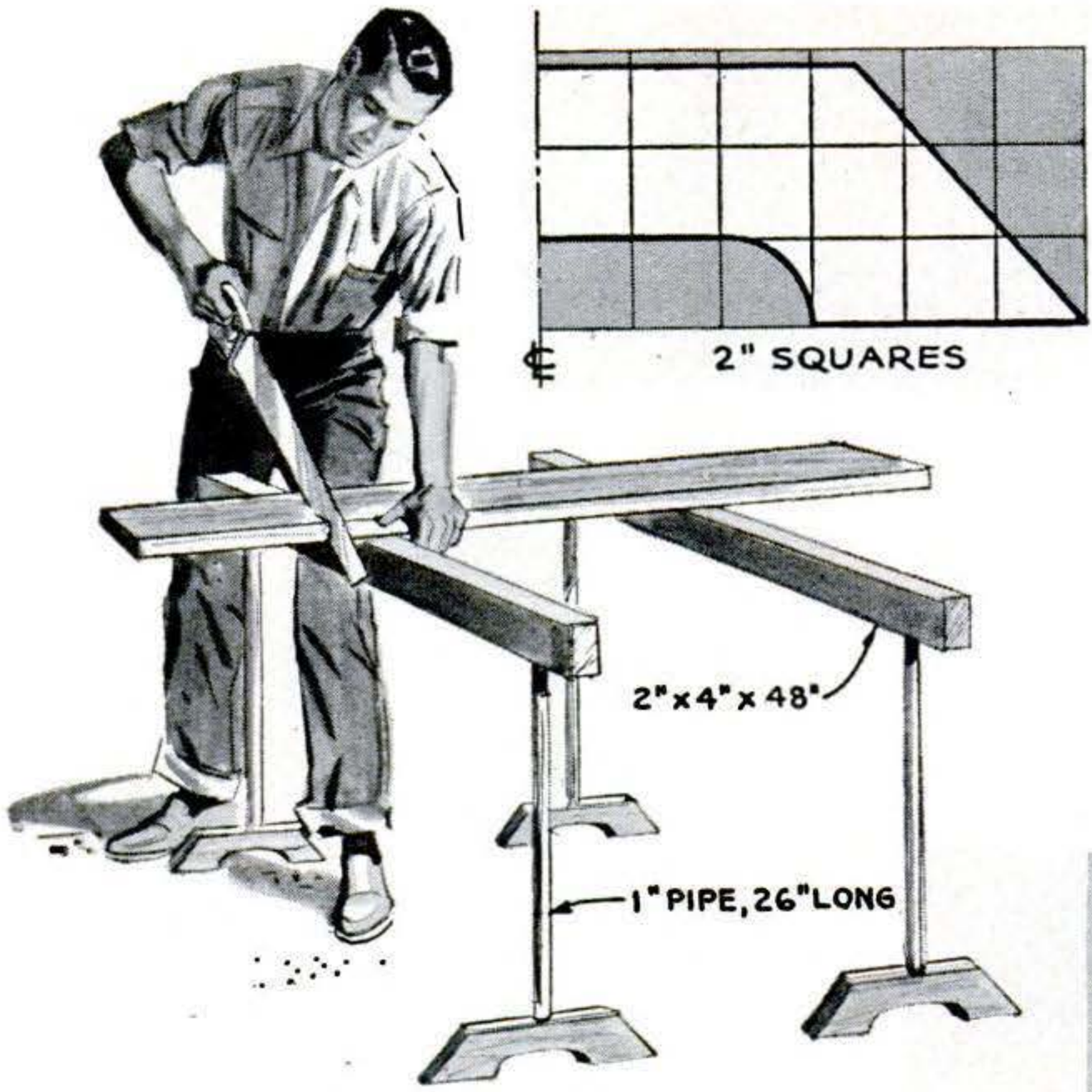


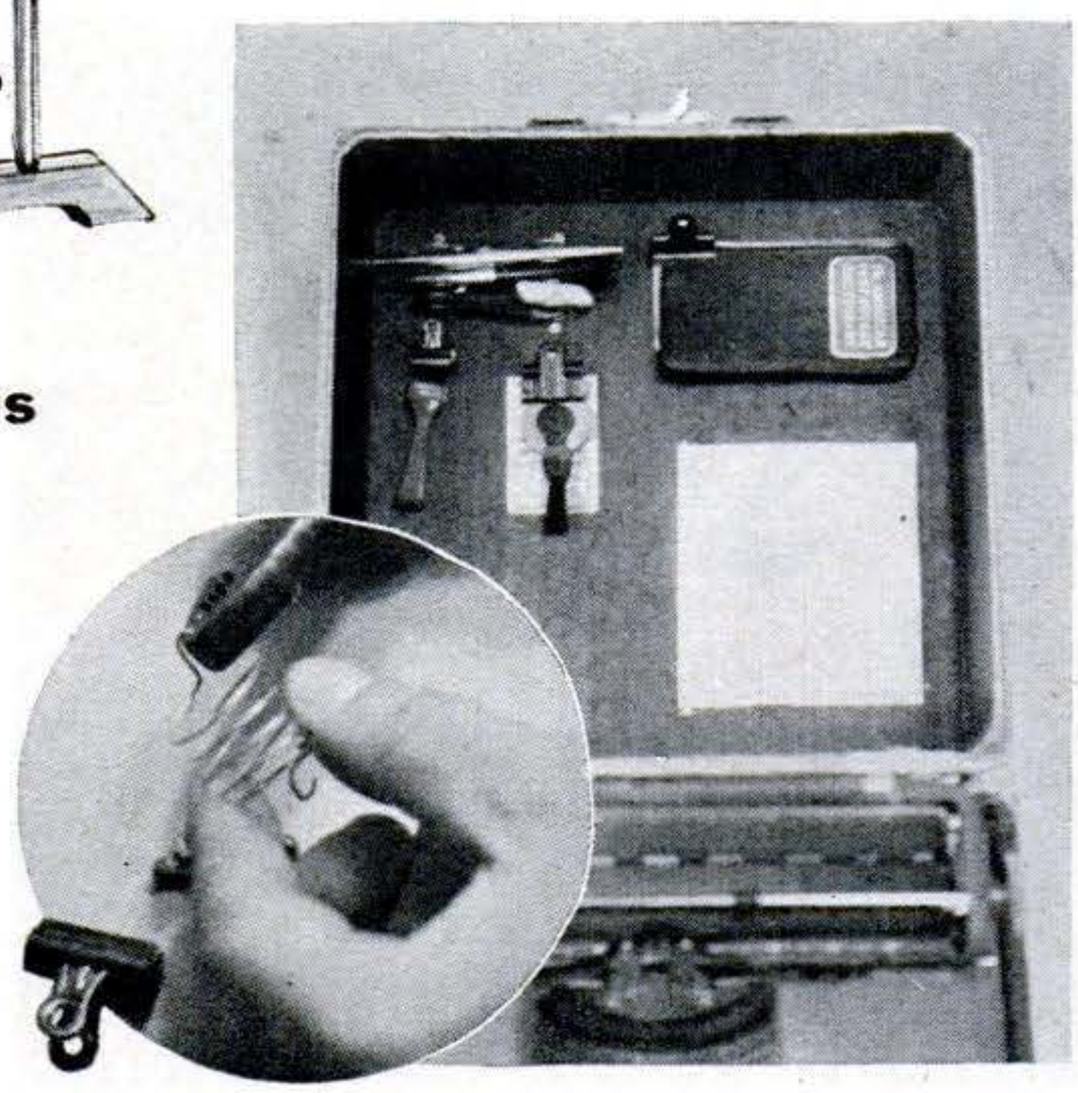
Sawhorses Fold Flat

A PAIR of these simple sawhorses will give years of light-duty service, cost practically nothing to build, and take little space to store.

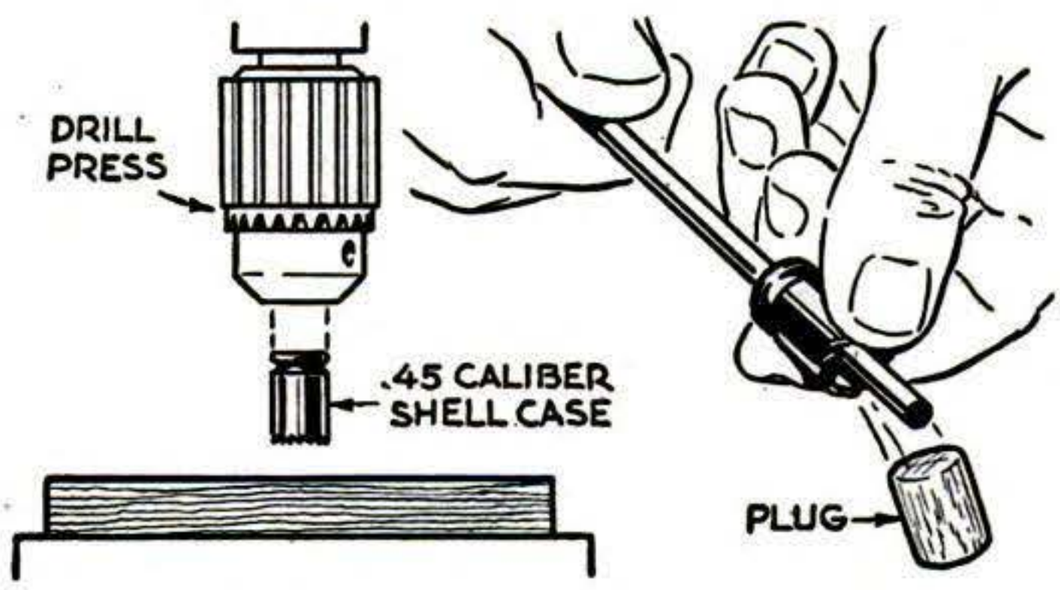
By swinging the legs parallel to the top, the horses can be folded flat, or the pieces can be quickly taken apart for carrying in a car. You can shape the legs out of lengths of 2″-by-6″ as shown for a pleasing appearance or simply leave them straight.—*J. W. Welker, San Bernardino, Calif.*

Typewriter Carries Office Supplies

YOUR portable typewriter becomes a traveling office if you fit it out like this to carry extra supplies. Spring-type paper clamps, bolted to the inside of this cover, hold stamps, labels, eraser and dictionary. To hold pencils and pens, bend eyes on the ends of two small coil springs, bolt the springs side by side, and press the pencils between the coils. A sheet of addresses can also be taped to the cover.—*Phil McCafferty, Fort Bliss, Tex.*



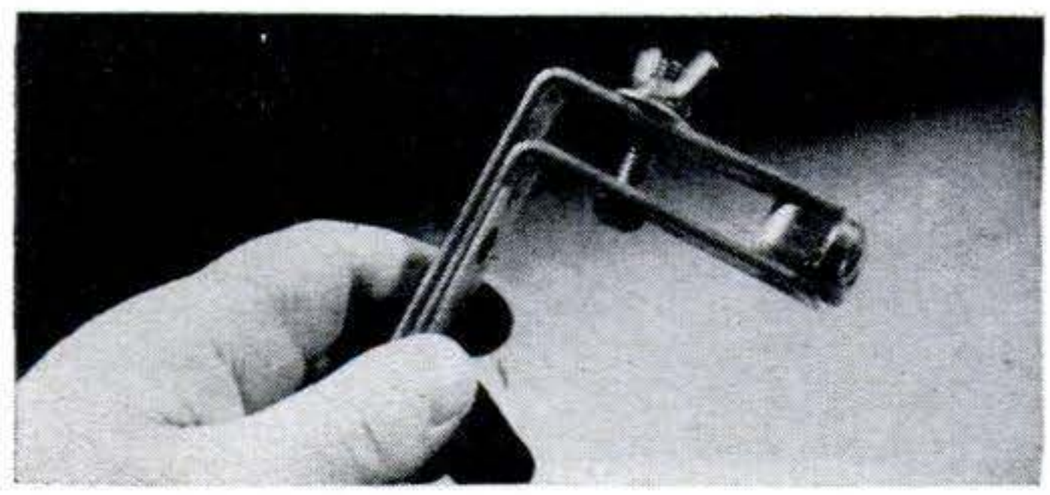
Wood Plugs Are Easy to Cut with Cartridge Case and Drill Press



DRILL the primer out of a rimless or center-fire cartridge case and use it in a drill press to cut plugs to cover screwheads in cabinet or other wood projects. Nick the edge of the case with a triangular file to form teeth. A .45-caliber case will cut a plug to fit snug in a ⅜″ hole. Other sizes may fill other needs. The plug is pushed out of the case with a small bolt.—*A. P. Truchot, Agawam, Montana.*

Clamp Made from Corner Braces

BOLT a couple of metal corner braces together, slip on a wing nut, and you have the handy C clamp at right. The longer the bolt you use, of course, the wider the clamp jaws will open. Strong enough for light work, the clamp can be taken apart at any time.—*Ken Murray, Colon, Mich.*



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Texaco Tips

on car care

How to keep your air filter clean

If your carburetor air filter is clogged with road grit and grime, it cannot perform its necessary function. The result? —your engine suffers from metal-wearing matter. To keep it clean, free from clogging sediment, see your Texaco Dealer. If necessary, he will remove the filter element and wash it thoroughly in kerosine. Oil bath type filters will get an oil change to the right seasonal grade, as needed. Extra care like this helps keep your car running better and running longer.

How to get that "cushiony" ride

Note the tight-clinging "collar" of *Marfak* lubricant on the front suspension. *Marfak* stays on the job far longer. It's extra-stretchy . . . forms a tough protective coating between points of friction and wear. With *Marfak*, you enjoy 1,000 miles or more of *cushiony* smooth motoring. Your Texaco Dealer lubricates your car by chart, never by chance. His lubrication guides include instructions for every make and model of car. Today, get *Marfak* lubrication. See your Texaco Dealer . . . *the best friend your car has ever had.*

THAT "CUSHIONY" FEELING LASTS LONGER WITH

THE TEXAS COMPANY

TEXACO DEALERS

in all 48 states

Texaco Products are also distributed in Canada and in Latin America

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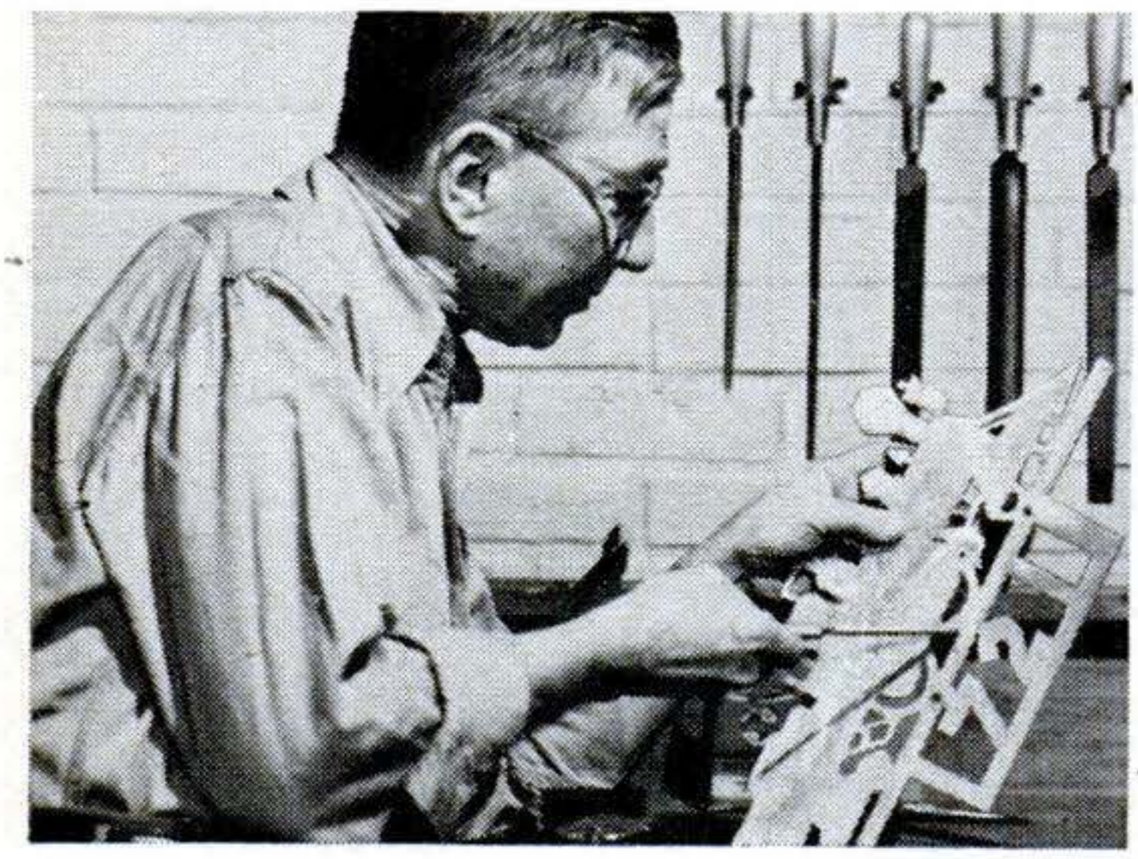
DO-IT-YOURSELF PROJECT WITH TRIPLE PAY-OFF



In making his own house sign (for example), this man is (1) saving money, (2) adding to the value of his home, and (3) having a lot of fun doing it.

What's more, his pride of achievement is heightened by his possession and use of *good* files. They're NICHOLSON. This and BLACK DIAMOND are the most famous two brands in the world.

He knows their teeth are sharp, evenly high, of uniform hardness, and have extra-long life. They're the choice of both the professional and the exacting amateur craftsman. They've the quality good hardware and tool-supply dealers like to recommend.

FREE—*"File Filosophy,"* Nicholson's famous 48-page illustrated book on kinds, use and care of files. Shows and describes many types of files for use on all sorts of projects comprising hard or soft metals, wood, plastics, etc. ***Send for it.***

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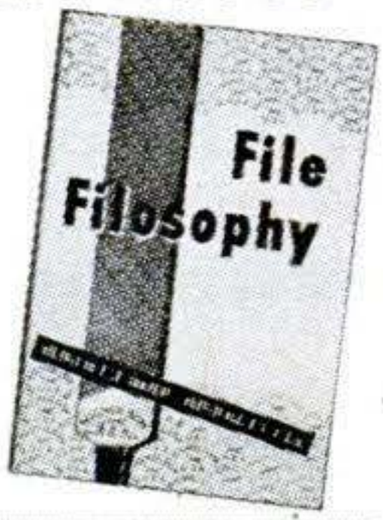

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Young Scientists Win What They Want

[Continued from page 153]

Adult scientists often find it hard to believe that young people can be so talented. Dr. Remington Kellogg, director of the National Museum of the Smithsonian Institution, who was chairman of the board of 11 judges in 1952, commented: "The whole fair was a great surprise to all of us. We were impressed by the efforts, interests and excellence of the exhibits. . . . It was extremely difficult to select the winners." Dr. Kellogg was particularly impressed with an exhibit of insects entered by Don Ray Davis of Oklahoma City. Don had found some insects that even Dr. Kellogg's institution, with a collection of more than a million, didn't have.

At Oak Ridge, Tenn., last year, the entries were so good that the judges—including some world-famous scientists—deliberated five hours, and even then had to make two extra second-place awards.

For Finalists: An Exchange of Ideas

Officially, the competition is for 12 "wish awards"—scientific equipment or books which each winner feels will help him continue his study and experimentation. A first award is worth $125; second, $75; third, $50. There are two of each of these in the physical sciences and two in the biological sciences. Boys and girls compete separately.

Actually, the rewards that go to each finalist are far more valuable than the prizes won by those who place first, second or third. First is the trip itself—to Philadelphia in 1950; St. Louis in 1951; Washington, D. C., in 1952; Oak Ridge, Tenn., in 1953; and next month to Lafayette, Ind., home of Purdue. Then come the opportunities to visit places where scientists work—industrial, government and university laboratories—and to talk shop with the people who work there. Answers to questionnaires show that entrants value these opportunities more than anything else, for they bring encouragement, fresh ideas, new

[Continued on page 264]

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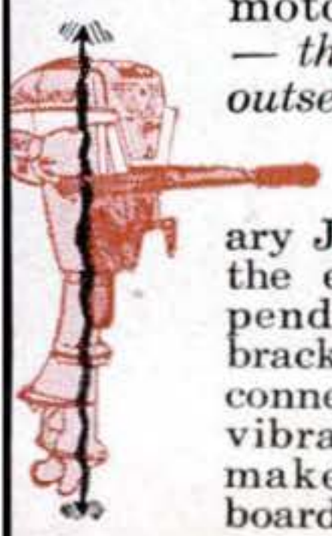
NOW... GO QUIETLY

This outboard motor is different. It's *quiet*. You slip away from the dock without disturbing your neighbors. You speed along without noise. You *talk* to your boating companions.

The Sea-Horse 5½ is *entirely* new. Suspension Drive. Air Intake Silencers. Exhaust Relief Silencer. Up-and-Off Motor Hood. Full Gear Shift. Separate 4-gallon Mile-Master Fuel System. Twist-Grip. Hi-torque power. And fitted for Ship-Master Remote Control! Never before have so many fine features been concentrated in a motor of this trim size — *the favored size that outsells all others!*



SUSPENSION DRIVE

With this revolutionary Johnson development, the entire engine is suspended from the stern bracket by four resilient connectors. This dissipates vibration that otherwise makes a vast sounding board of your boat.

FREE! Write for the new Sea-Horse Catalog. See your Johnson Dealer. Look for his name under "Outboard Motors" in your classified phone book.

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5 GREAT SEA-HORSES FOR 1954

ELECTRIC STARTING SEA-HORSE 25—25 hp. The "automatic" outboard..... **$498.00***
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SEA-HORSE 5½—5½ hp..... **$210.00***
SEA-HORSE 3—3 hp..... **$145.00**
SHIP-MASTER REMOTE CONTROL—Fits Sea-Horse 5½, 10 and both 25's. From . **$29.50**

*OBC certified brake hp at 4000 rpm. Prices f. o. b. factory, subject to change. *Includes Mile-Master Fuel System.*

Johnson SEA-HORSES FOR DEPENDABILITY

The Sea-Horse 5½ is the first outboard motor ever to win a citation from the National Noise Abatement Council.

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[*Continued from page 160*]

"I know," Gus said, his eyes sweeping over the landscape.

The usually peaceful canyon had been transformed in a few minutes to a scene of wild turmoil. The trees along Rolling Rock Creek leaned far over under the force of the wind, and sheets of rain lashed at their branches. A long drift log had wedged across the stream a little way below the truck. Drift had piled against it to form a dam.

The Flood Creeps Closer

Even as Gus watched, a giant uprooted tree rushed at the dam, struck it with the power of its tons of driven weight, and rose 20 feet into the air, quivering there like a shaken bush. The entire tree had become part of the dam.

The water now lapped at Gus's knees. Piled up behind the dam, it was two feet over the stream's normal banks. Near the truck, sections of the bank had begun to crumble away and topple into the current. The truck driver was hanging on to Gus's arm, shaking it, and his voice was shrill with terror.

"We've got to get out of here!" he cried.

Gus turned to face him, his gray eyes calm and level. His big, work-worn hands fumbled with his pipe, tamping in tobacco with a wet thumb.

"Don't panic on me, man," Gus said. "If we leave that truck here, within the hour it'll be lost, toppled into the drink, cargo and all."

"But we can't do anything by staying here," the driver protested, "except get drowned ourselves."

"Maybe," Gus said, his eyes suddenly narrowing with thought.

He moved swiftly now, stooping to open his tool kit and bring out a coil of primary ignition wire. With his knife he quickly stripped off the insulation, and with three feet of soft copper wire in his hands, began wrapping it again and again around the long blade of his screwdriver. At the other side of the truck, Gus raised the hood, stooped to place one end of the copper wire on one battery terminal, while he rapidly struck the other end back and forth across the opposite battery post. Blue sparks flew, and the scent of ozone drifted off on the wind.

A moment later, Gus was on his way back to the first side of the truck, stripping the wire from the screwdriver blade as he went. He reached down into the deep distributor-shaft recess with the blade, withdrew it with the troublesome spring clinging to the end. With a few deft movements he rammed the distributor in gear correctly, slipped the spring on the stud below the washer, tightened it in place, connected the spark vacuum-control tubing, slammed the hood down and latched it.

"Get under way, Steve," he yelled. "Back her out on the road, away from that creek bank. Quick, man! That bank's about to give way."

A half-hour later, Gus drove his dripping car into the Model Garage. Steve Holloway pulled the truck up under the canopy of the pumps and leaped out to enter the garage.

Gus Describes Screwdriver Magnet

"Brother!" he exclaimed. "That was a close one. How'd you get that spring out of there so quick, Gus?"

"Always remember," Gus told him, "what I darn near forgot up there in the hills. You can make a strong magnet out of a screwdriver blade, provided it's of good steel, by wrapping it with wire and making and breaking juice through it from a battery. I should have thought of it sooner. Guess I'm getting absent-minded in my old age."

"You sure are, Gus," Stan Hicks called from the grease rack. "Dump your shoes. Don't you know they're full of water?"

Gus looked over to his helper and grinned as he scratched a match on the bench and applied it to his pipe. Come to think about it, he'd forgotten to light up when the thought about the magnet finally struck him. END

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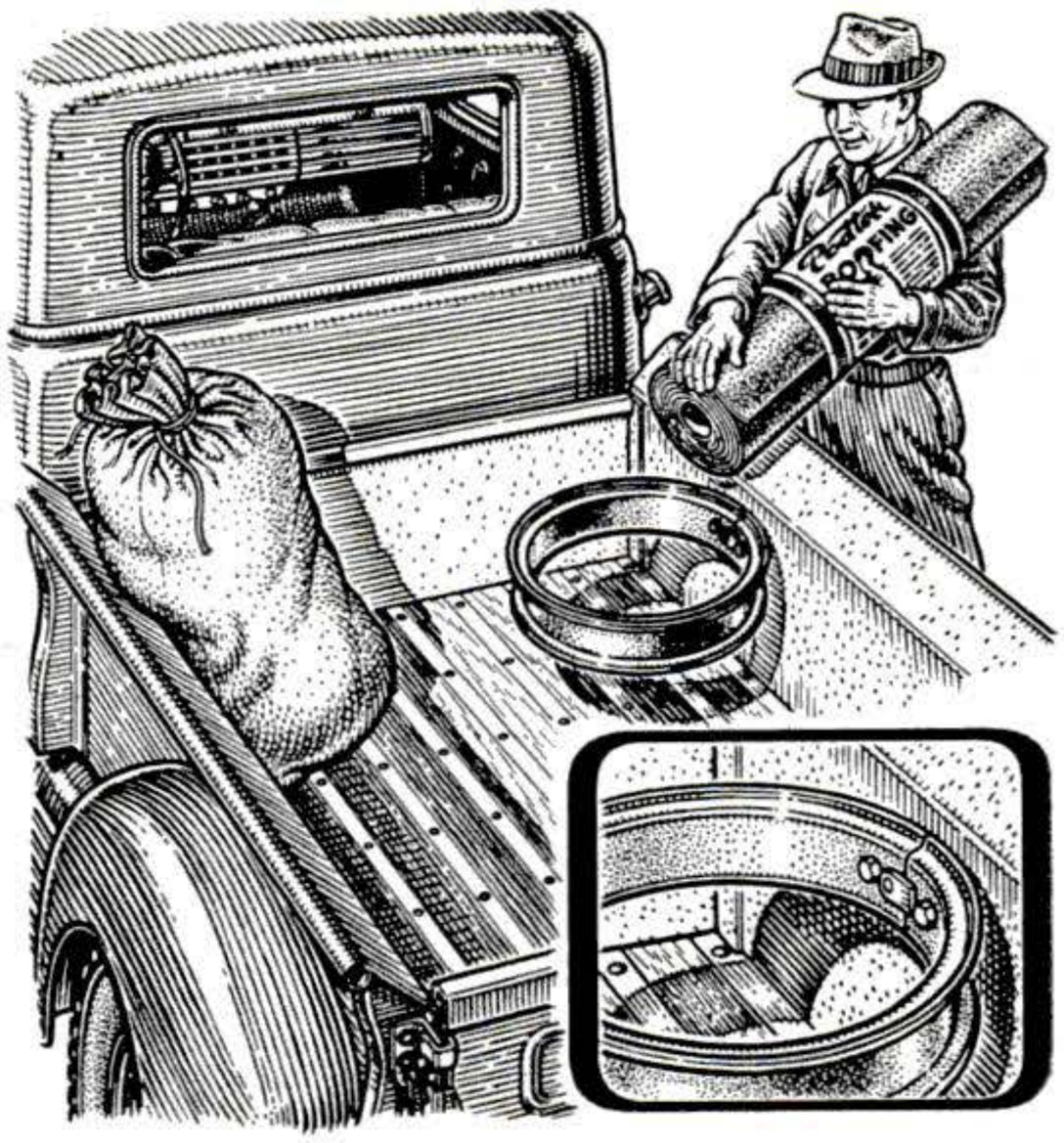
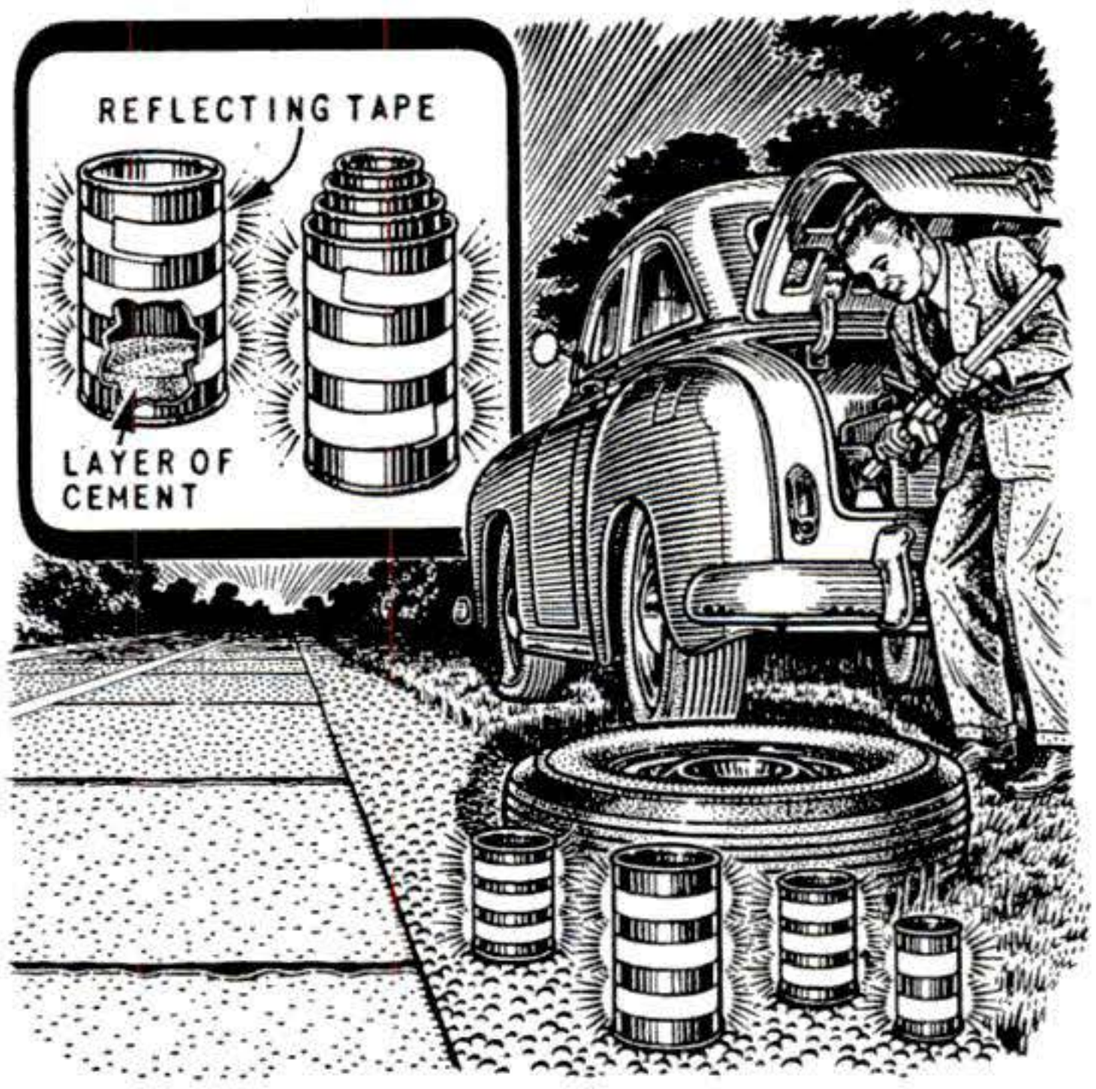
Hints FROM THE MODEL GARAGE

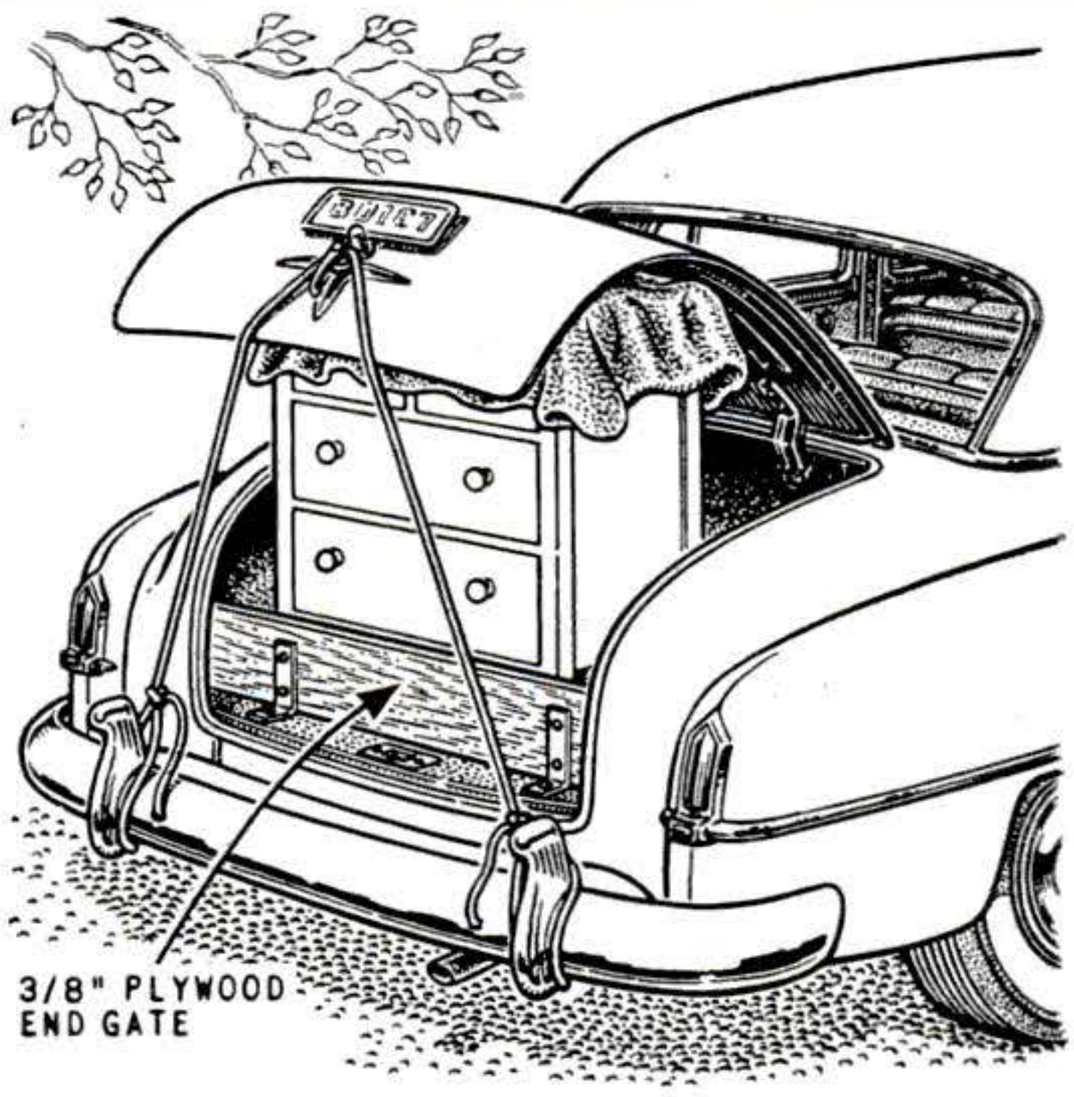
Rub soap inside hose ends when installing new connections between the radiator and motor block. They'll slip on the fittings easily and save you much pulling and tugging. For a thorough job, sandpaper the rust off the fittings and use new clamps.



Bolt one or two truck-tire rims to the side of a pickup truck to keep cylindrical objects like oil drums or rolls of roofing from rolling about. Bolt the rims as high up from the floor as the sides will permit to keep the loads from tipping out.



Wrap reflective tape around tin cans to warn passing motorists when you're stuck or changing a tire. Use cans of different sizes so they will nest compactly in the trunk and pour a little cement in the bottom of each can to keep them from blowing over.



Put a plywood end gate across a low trunk opening to keep tools from rolling out when transporting a large object with the trunk lid up. Set it back far enough so that it won't interfere with the latch and secure it with metal angles bolted to the floor.

Please turn the page for more auto hints.

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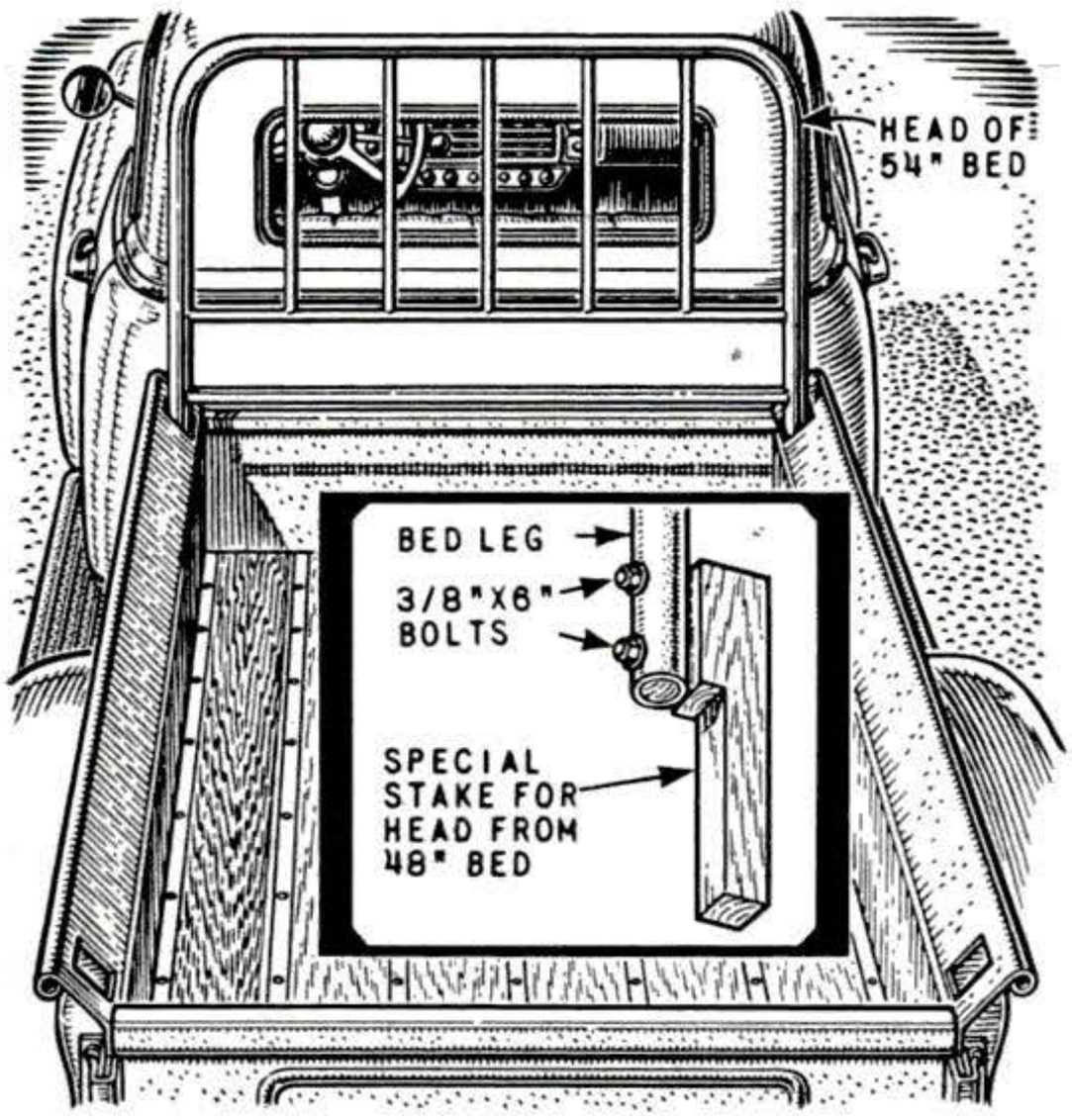
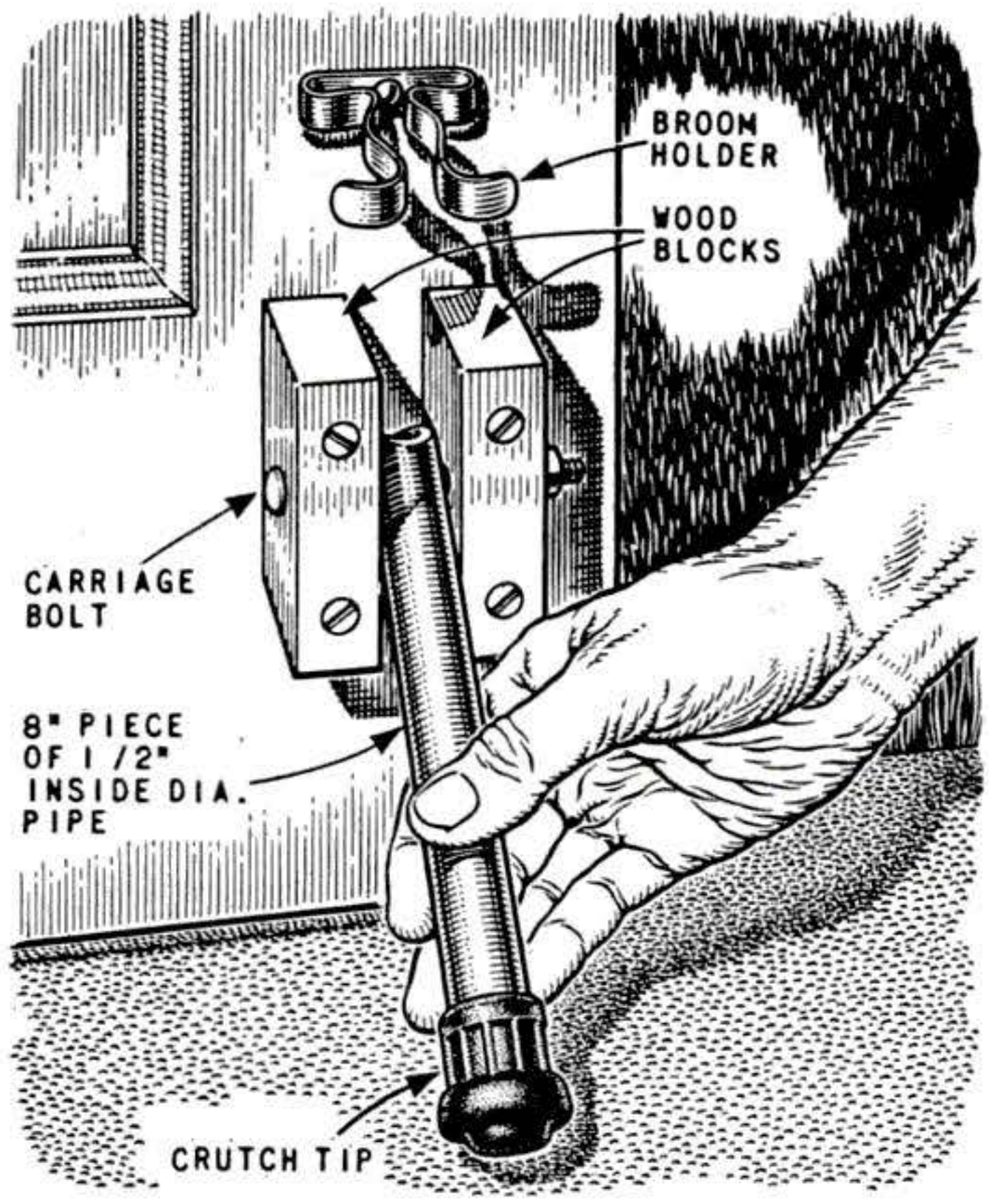
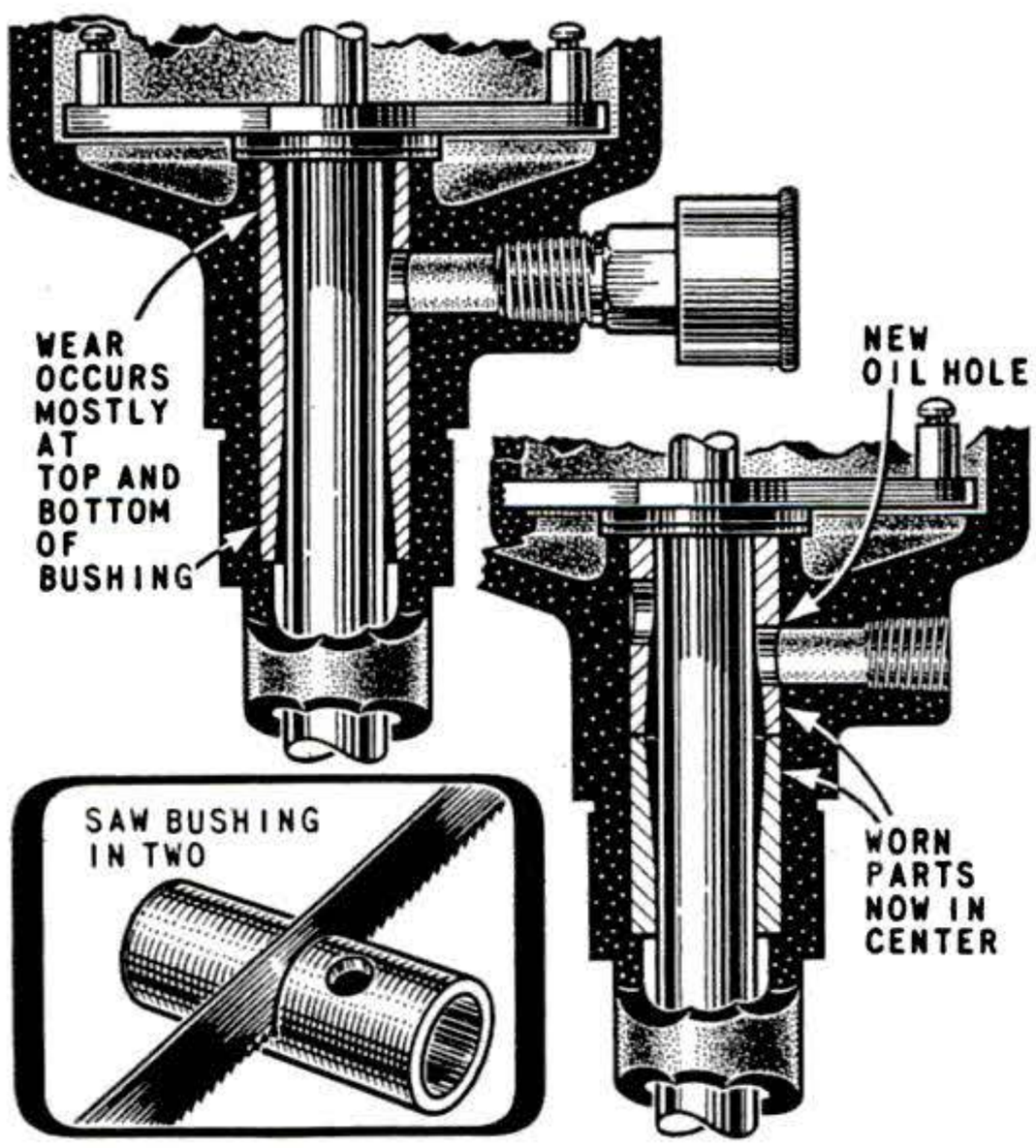
MORE Hints from the Model Garage



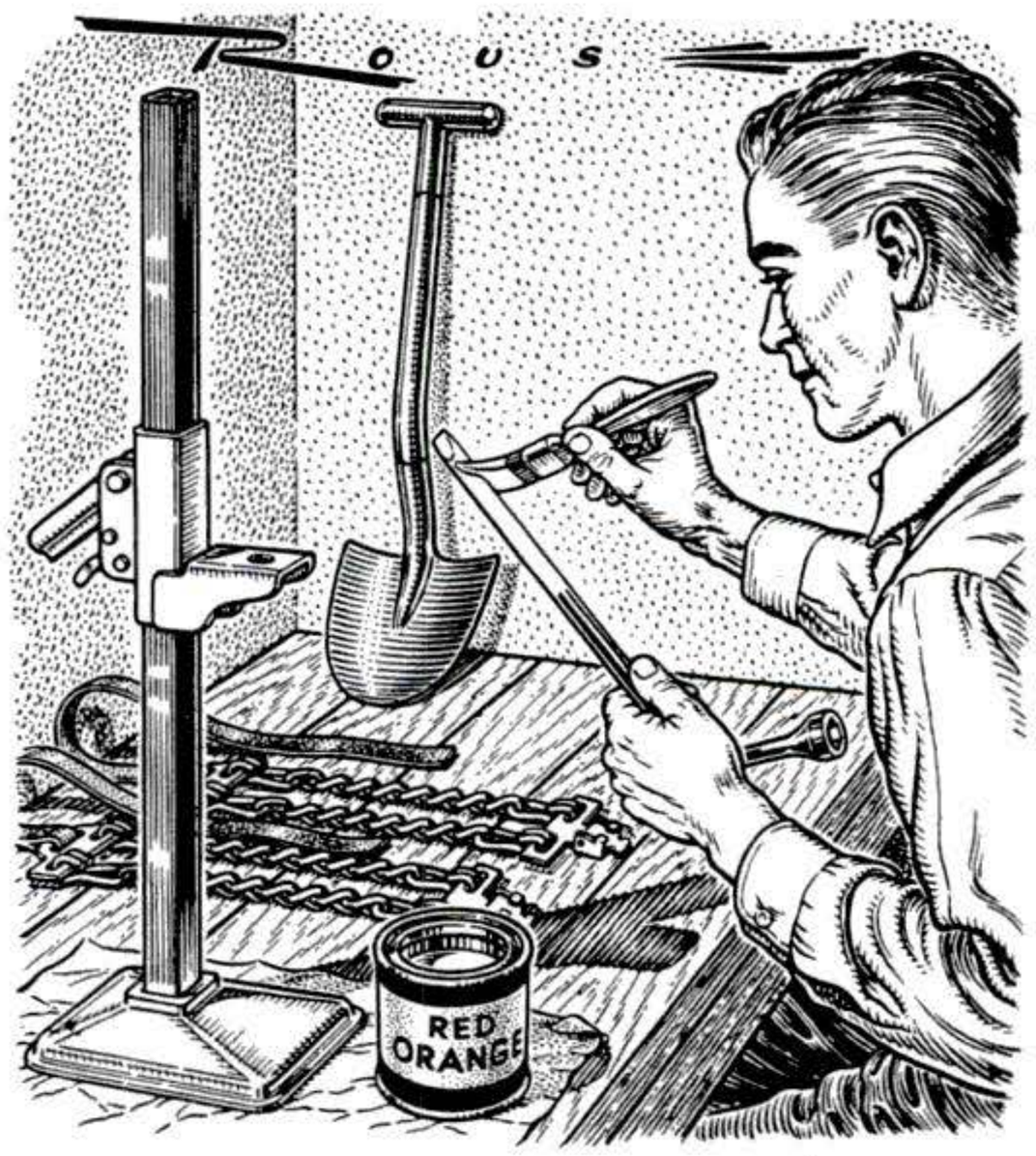
Use the head of an old metal bed to keep the load in a pickup truck from crashing through the rear window when you stop suddenly. Cut a hole in the body sides for the legs. Make the head of a narrow-width bed fit by adding wood extensions (inset).



Keep the garage door open while you back out by pivoting a piece of pipe on a bolt held by two blocks of wood screwed to the inside of the door. A rubber crutch tip keeps it from slipping and a spring clamp stores it up out of the way.



When a distributor bushing wears, play in the shaft affects engine performance. Because most wear is at the bushing ends, you can save fitting a new one if you cut the old bushing in two, drill a new oil hole and put it back with the center sections out.



Paint car tools bright orange or yellow to make them easier to see. Then you'll be less likely to leave them at the roadside when you take them out in snow or at night to change a tire or make repairs. The paint will also keep them free from rust.

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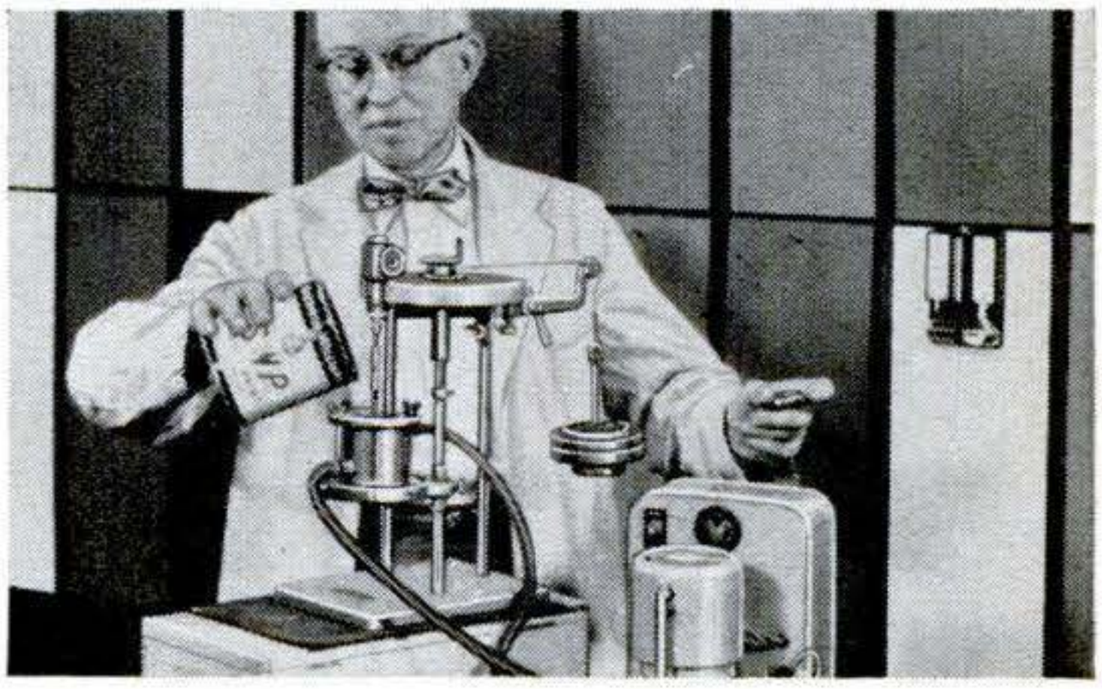
SWP HOUSE PAINT

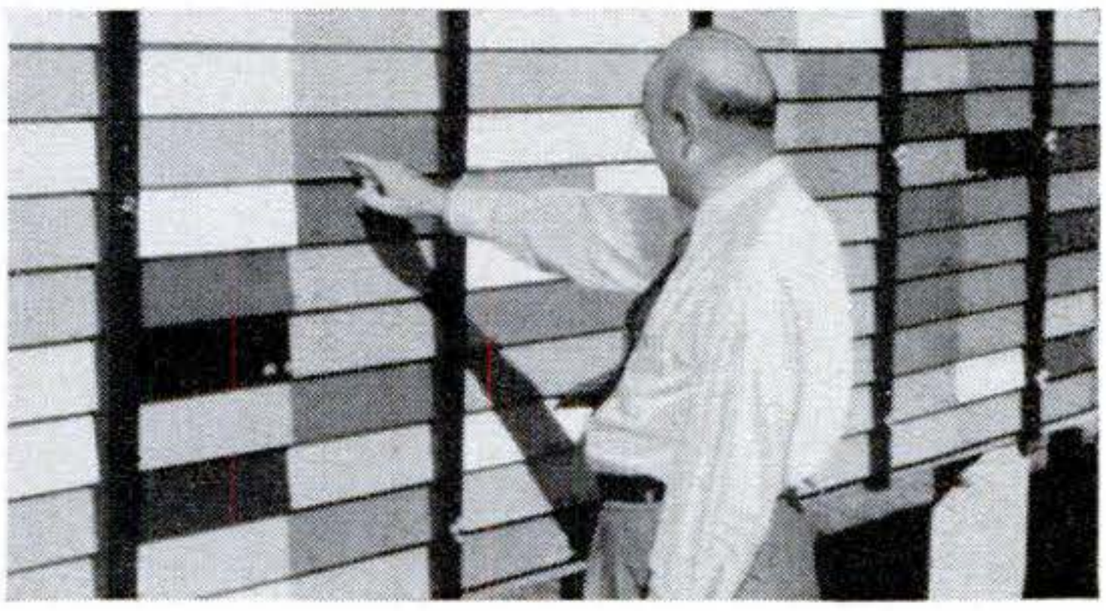
Lasts Longer... Saves Money

It pays to be "choosy" when you select the *brand* of house paint to be used on your home. Whether you employ a painting contractor or not, the price difference between world-famous SWP® House Paint and house paint of ordinary quality will mean less than $5.00 for the average-size, complete house job. This slight difference in cost pays for years of extra wear and is one of the wisest economies you can make.

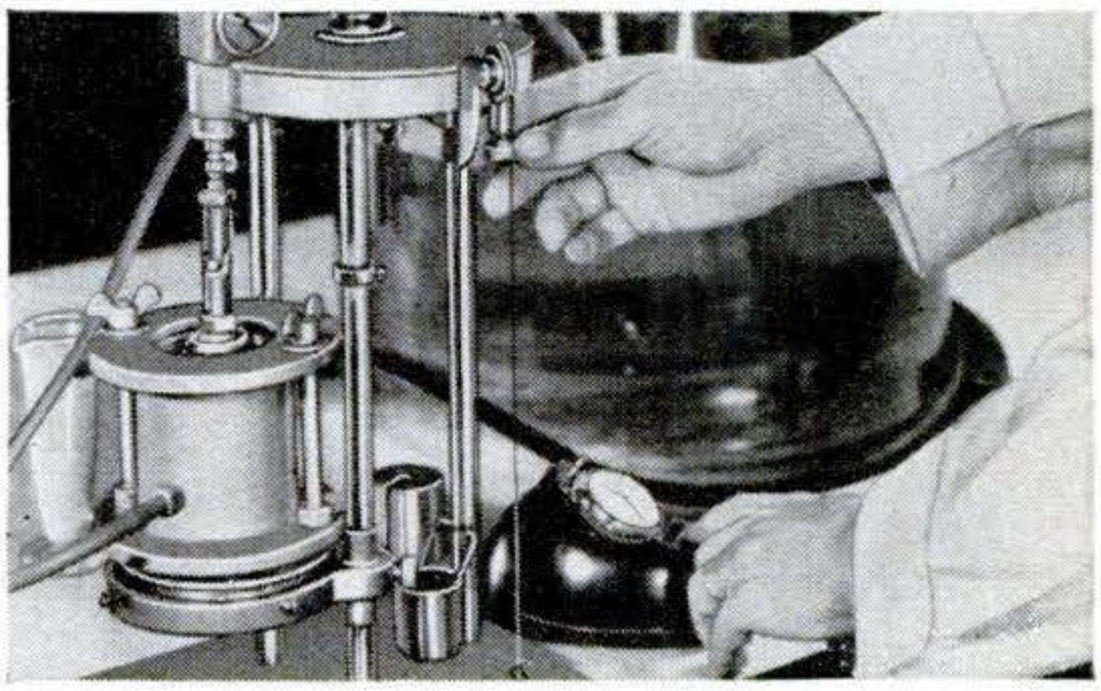
In 1953, Sherwin-Williams SWP House Paint was used to paint more homes in America than any other brand. Why? Continuous research in Sherwin-Williams Testing Laboratories and in the field has insured constant improvement and the top-quality performance of SWP. You'll be money ahead when you discover there *is* a difference in house paints!



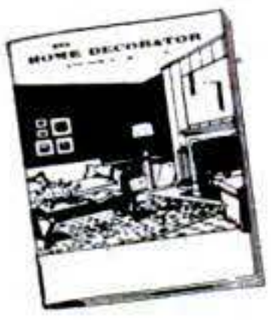
Tested for Your Protection . . . A most exacting procedure of quality-control testing through every step of manufacture, from raw materials to finished product, assures maximum beauty and protection in SWP House Paint. Laboratories in every Sherwin-Williams factory are charged with the responsibility of absolute quality control of every gallon produced.



White and Colors That Last . . . All over the country, in all climates, Sherwin-Williams maintains test stations where house paints of every type and description are exposed to years of weather and wear. SWP white that stays *whiter* and SWP colors that maintain their brilliance are the direct result of this painstaking research.



Ease of Application Assured . . . Invented by Sherwin-Williams Testing Laboratories, this instrument, known as the high shear viscometer, is an extraordinary development which makes possible the scientific measurement of the brushing qualities of paint. This testing procedure has made possible the superior brushing qualities in SWP House Paint which insure remarkable ease of application.



FREE: For full information on SWP House Paint and lots of interior decoration ideas, too, ask your dealer for a copy of the 44-page "*Home Decorator*" or write to The Sherwin-Williams Co., 1260 Midland Building, Cleveland 1, Ohio.

Let us recommend a reliable painting contractor.

Go to the store that displays this famous trade-mark . . .

SHERWIN-WILLIAMS HOUSE PAINT

ON TV . . . TUNE IN THE SUPER® KEM-TONE SHOW, STARRING RAY BOLGER . . . ABC NETWORK EVERY WEEK

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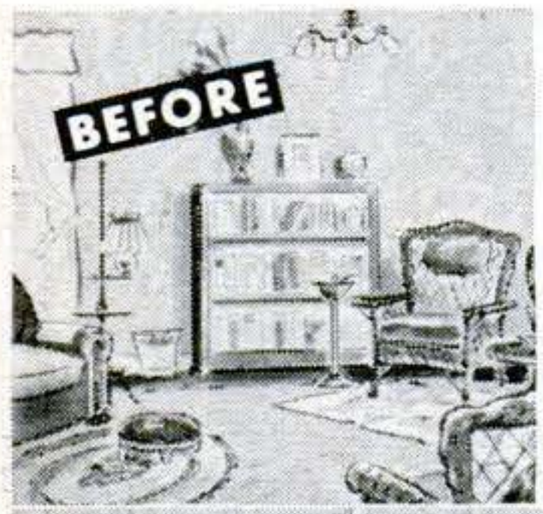
Beautify your old rooms

with easy-to-apply Gold Bond Insulation Planks!



Take any old room. Get some low-cost, easy-to-handle Gold Bond Insulation Planks . . . you can put them up yourself, and you'll soon have the best-looking, most comfortable room imaginable!

Easy to do because Gold Bond Insulation Planks are ready-cut. Interlocking edges slide together, hiding nails or staples (whichever you use). No painting either, for planks come in ivory or variegated blend of four pleasing colors. Insulation is built-in to keep winter heat *in*—summer heat *out!* For a handsome, sound-absorbing ceiling use Gold Bond Insulation Tile.

Get these "Do-It-Yourself" materials today at your Gold Bond dealer. For more information mail coupon today! National Gypsum Company, Buffalo 2, New York.

MAIL COUPON TODAY

NATIONAL GYPSUM COMPANY
Dept. PS-44, Buffalo 2, N. Y. S

Please send me free folder, "Four Ways to Give Your Home New Beauty."

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Young Scientists Win What They Want

[Continued from page 258]

horizons. Any scientist who has ever spent an hour exchanging ideas with high-school students can be assured that his reward is great: the youngsters love him for it.

What happens to science-fair finalists? "It is too early to say how many become actual scientists," reports Joseph H. Kraus, the fair's coordinator. "But the evidence indicates that judges of local science fairs are doing a remarkable job of recognizing potential scientific manpower while the boys and girls are only sophomores, juniors and seniors in high school."

Margaret E. Patterson, executive secretary of Science Clubs of America, checked up last May and found that almost half of the 102 finalists in the first three national fairs had gone on to college, all but three of them concentrating in scientific or engineering fields. Most of the others were still in high school, planning to go to college.

Of last year's 71 finalists, all but a dozen planned to follow a career in science, engineering or medicine.

"For the Fun of It . . ."

How do you get a youngster interested in scientific matters? Twenty percent of last year's finalists credited home influences with having drawn them into the world of science. Forty percent named their schoolteachers. Others listed science magazines, science-fiction movies and friends.

Whatever the start, science fairs help to nurture youngsters' interest and carry it over into the adult years. Science teachers themselves applaud the statement of Dr. Irving Langmuir, a Nobel prize winner in chemistry. "If you work out a small problem by yourself for the fun of it," he told science-fair exhibitors at Socorro, N. Mex., "you will learn more science than they can teach you in school." END

NEXT MONTH* Popular Science *will tell you about—and show you through—Uncle Sam's free college for ship's officers.

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TRIAL ORDER or FREE '900' CIRCULAR

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☐ *FREE FACTS:* Send for new free Syncro Sanders Circular, Free "How to Sand" booklet.

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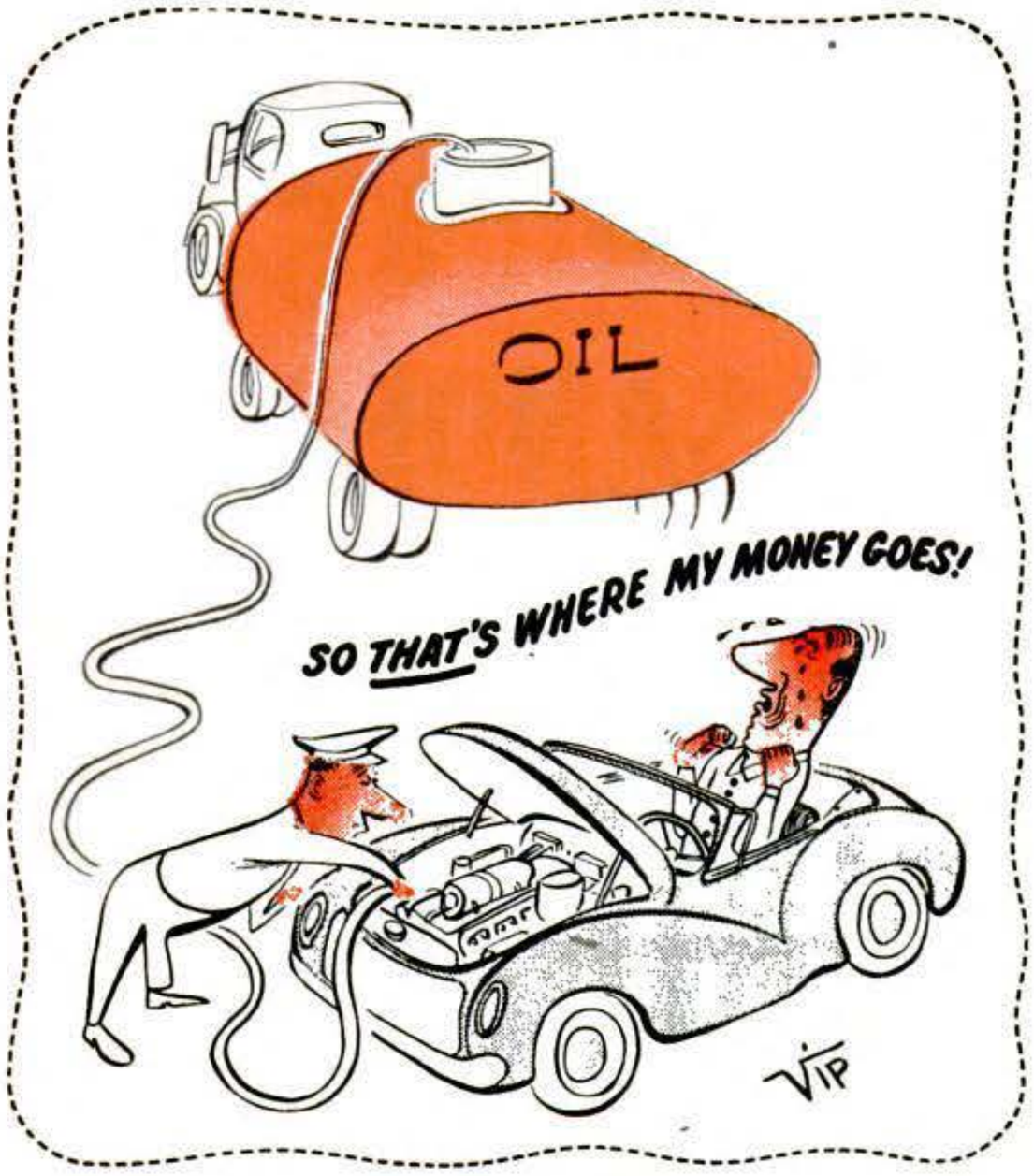

This oil-pumper needs Tough-but-oh-so-gentle piston rings*

Oil pumping is just the start of expense and trouble—the first danger signal from worn-out piston rings. The longer you let those old rings stay in, the more oil you'll use, the more power you'll lose, and the bigger your repair bill will be!

As your engine gets older, it runs hotter because of accumulations in the cooling system. The cylinders wear tapered and out-of-round—need more oil on the walls.

It requires a special type of piston rings—replacement rings—to deliver this extra oil, under full control, without waste.

Hastings makes replacement rings exclusively, devotes all its research on the highways and in the laboratory, to the particular replacement problems of each make and type of engine.

That's why Hastings Rings *stop* oil-pumping, *check* cylinder wear, *restore* engine performance—in re-ring, re-bore and re-sleeve installations.

So go to your motor specialist at the first sign of oil-pumping or performance drop-off. If rings are the trouble, ask him to install a Hastings Steel-Vent replacement set. Truly the best money you can spend on your car! Hastings Manufacturing Company, Hastings, Michigan: Hastings Ltd., Toronto; Piston Rings, Spark Plugs, Oil Filters, Casite, Drout.

HASTINGS
STEEL-VENT PISTON RINGS

U. S. Climbers Assault Makalu

[Continued from page 99]

violent political activity, a broken marriage, combat in battle. Intense sustained anxiety, above almost everything else, either produces or is associated with the physiological changes that result from stress.

Stress diseases include stomach cramps, rheumatoid arthritis, battle fatigue, asthma, duodenal ulcers, hypertension, some heart diseases, and possibly ulcerative colitis. These ailments are increasing in civilized nations. If stress can be studied in the mountains, it may be ameliorated elsewhere.

For research purposes, the expedition will be disappointed if Makalu is not tough enough.

There is little chance of this.

Is There a Way to the Top?

For more than 30 years every expedition on the way to attempt Everest has also tried to figure out a way to Makalu's summit. None has.

Its awesome rigors have kept anyone from trying to climb the soaring peak up to now. William Siri and his Californians are the first men to approach the mountain. Indeed, only one expedition has been anywhere near Makalu's base. That one, in 1951, included Hillary and Eric Shipton. From slopes nearby, they looked down upon the Barun Glacier and the ice falls surrounding Makalu.

Knowledge of animals of the Everest-Makalu area, Siri points out, will shed new light on how life exists in a high-stress environment. Accordingly, two members of the expedition have been designated to gather animal specimens.

Plants will provide still more knowledge of life under extreme conditions.

As you might expect of a party of scientists, the most careful preparations have been made for attacking Makalu.

There will be two-way radio for communication between camps and the two-man parties that will make the final assaults on the summit. A base-camp radio will bring in weather news. (Maka-

[Continued on page 268]

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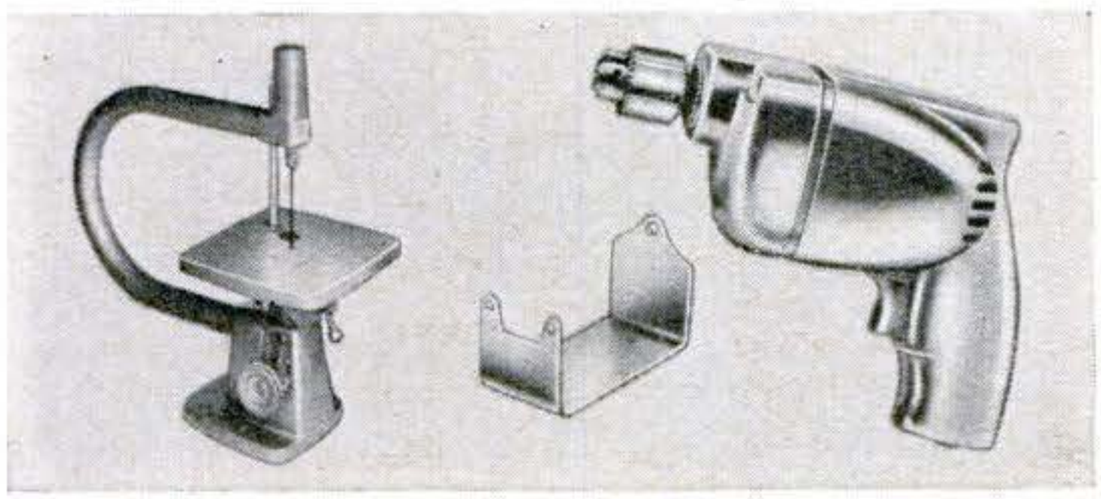
"We Really Make Hardware Week a Big Event for You at Cummins,"

says Paul Jones, president, Cummins-Chicago Corp.

Hardware Week, this year, is April 16 to 24—and it's a big event, with hardware stores everywhere offering you terrific special buys. At Cummins, we go all out to help our good friends, the hardware dealers, with Hardware Week bargains in power tools.

Again this year, good hardware stores everywhere will be featuring not one . . . but *three* Cummins Power Tools specials, all of them wonderful buys. Most outstanding buy of them all is Cummins NEW **do-it** Jig saw that you can operate with any good-quality drill, ¼" or larger, you now own. The **do-it** Jigsaw sells for only $24.95, complete, with no extra expensive motor to buy. Here are the Cummins Specials to look for at your Hardware store during Hardware Week:

Cummins Hardware Week Special No. 1

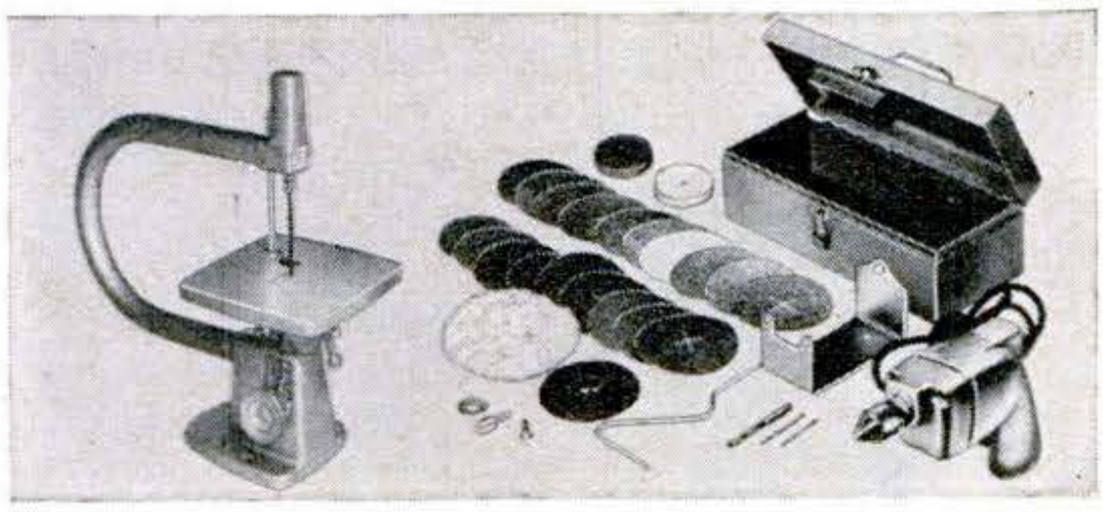


do-it Jigsaw, Drill Stand, Ball•Rite 44 Drill

Regular $56.15 Value— Hardware Week Only $49.88

Save over $6 on this outstanding bargain offer! Ball•Rite 44 finest industrial quality ¼" drill, mounted in stand, runs the jigsaw. Or, can be used independently, of course, for drilling, buffing, sanding, polishing.

Cummins Hardware Week Special No. 2

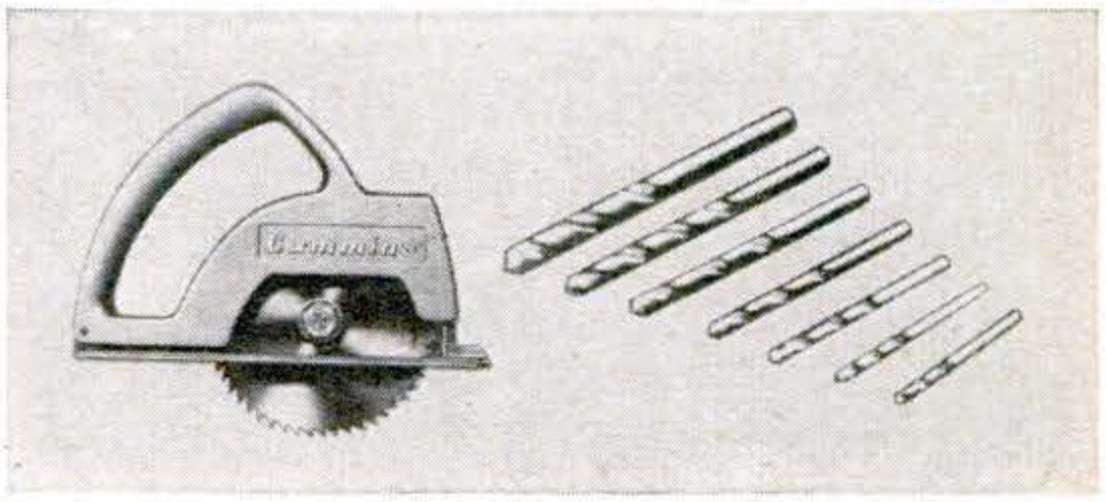


do-it Jigsaw and Fixmaster Drill Kit

Hardware Week Only Both for $42.95

Kit has 36 pieces, including Cummins Perm-Align Drill, which powers jigsaw. Complete outfit for drilling, sanding, grinding, buffing and jigsawing. Big value!

Cummins Hardware Week Special No. 3



Circular Saw Attachment and Set of 7 Drill Bits

Hardware Week Only with Any Cummins ¼" Drill $1.88

Less than factory cost! You save almost $8. Buy any Cummins ¼" Drill at $17.95, $21.95 or $29.95 and for just $1.88 more you get this sensational 4" saw and drill bit combination.

About the New do-it Jigsaw

The NEW do-it Jigsaw featured in Offers No. 1 and 2 runs with any good drill, ¼" or larger, you now own—big capacity . . . cuts wood up to 2" thick to center of 28" circle. Blade turns 90° for unlimited length of cut without interference from overarm • Overarm quickly removes for unlimited saber sawing, sanding and filing sticks • Exclusive Recipro-Flo Drive gives smooth balanced power without blade vibration or "flutter". . . blade breakage is reduced to minimum • Driving mechanism (exclusive Recipro-Flo Drive) operates in self-lubricating bearings for long, trouble-free service • Multi-purpose chuck allows use of either pin-type or blank-end blades • Built-in blower keeps cutting line sawdust-free for greater accuracy • Large work table tilts to any angle up to 45° for precision angle cutting • Adjustable hold-down foot gives hairline cutting accuracy in any thickness of wood • Jigsaw comes complete with Pulley, V-Belt, 3 Assorted Saw Blades, Adjusting Wrench and Mounting Hardware. Ready to operate with your drill. $24.95

Go to your hardware dealer now and reserve one or more of these Cummins money-saving buys. Then, you'll not be disappointed! If you would like FREE illustrated material on any of these outstanding power tools, drop me a line.

Sincerely, Paul Jones PRESIDENT

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U. S. Climbers Assault Makalu

[Continued from page 266]

lu gets exactly the same storms that Everest does. This means blizzards, 100-m.p.h. winds, 50°-below-zero cold.)

Other equipment includes two 8-by-10-foot tents, smaller two-man tents, primus stoves, standard air mattresses, and, for bridging crevasses, a 30-foot aluminum ladder that breaks down into six-foot lengths for carrying. Although the Everest expedition last year used oxygen, the Makalu expedition will take none—except for medicinal purposes. No mechanized sledges, winches or weasels (snow trucks) will be used. The expedition had no way of getting such things across Nepal's mountains and valleys.

Why don't they use helicopters or planes to bring in supplies or equipment? They can't. Helicopters, with no forward motion on the ground, cannot take off at high altitudes.

Parachute drops are not feasible, either. An enormous dropping area is needed—not a small ledge or peak. Arctic explorers, on wide ice fields, can be supplied by air; mountaineers cannot.

Pathway to the Clouds

To reach Makalu, the Californians crossed the Pacific to Calcutta, India; then rode a narrow-gauge railway to Jogbani (altitude: 300 feet). From there they marched 175 miles across Nepal—the first white men to pass through the upper Arun River valley.

Near the valley's end, they will turn west onto the Barun Glacier. Here they will have to ascend, within 20 miles, from an altitude of 4,500 feet to 17,500. Severe stress can be expected to burden the men on this stretch. At the end of this hike upward, the men will still have two miles of mountain to climb.

To do it, they will have to find a path across the Barun, so far untrod by white men, and then that path up Makalu—the route Hillary and other Everesters could only wonder about. END

NEXT MONTH* Popular Science *will show you the fanciest tree house you ever saw, and tell you how it was built.

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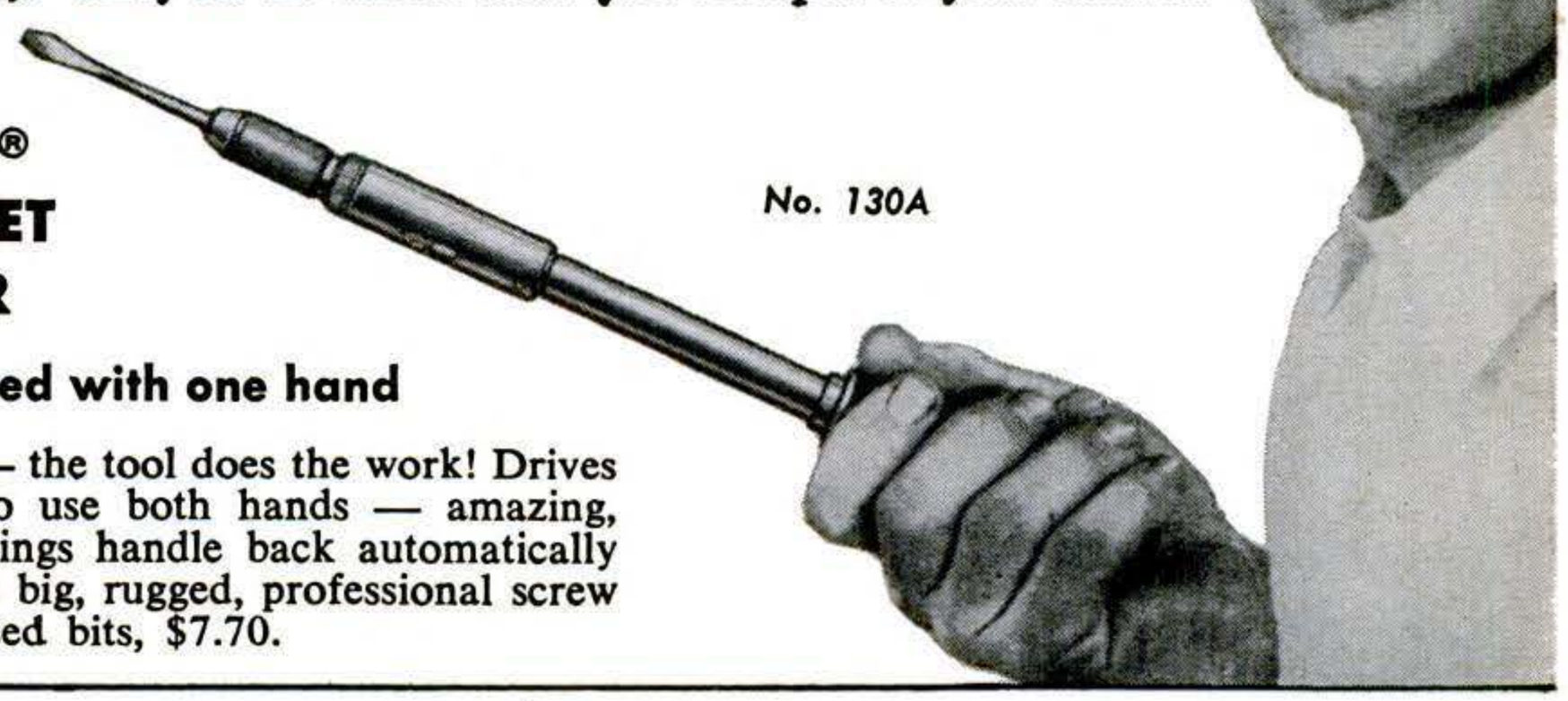
"Sure, I'm Confident!"

"I have the tools to do the job!"

Start a project feeling like this — and, brother! — you'll do a wonderful job! And you *can* start with that kind of confidence. How? *Tool up with Stanley!* They're the finest tools you can put in your hands.



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No. 130A

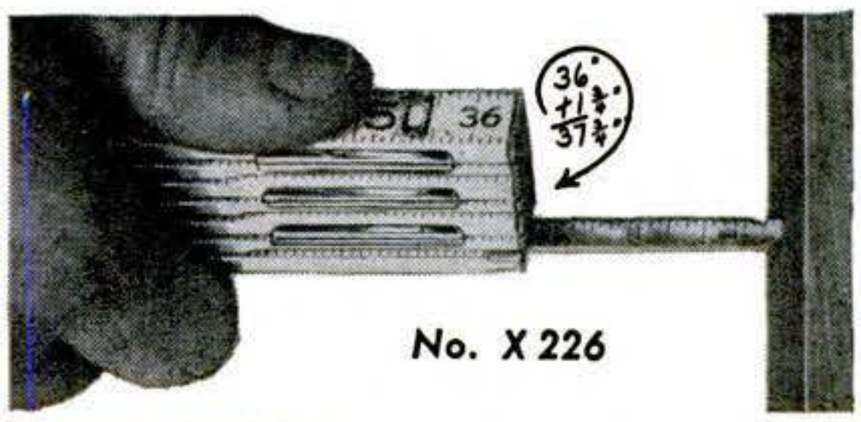
Can be used with one hand

Just push the handle — the tool does the work! Drives or draws. No need to use both hands — amazing, quick-return spring brings handle back automatically after each stroke. This big, rugged, professional screw driver, with 3 most-used bits, $7.70.

No. 11½

FINEST HAMMER! *Drive the nail in straighter* with the famous *Stanley "100 Plus"!* Extra power in every stroke — more accuracy, too — thanks to Stanley's balanced 2° toe-in design. Choice of curved or ripping claw. $3.50* (16 oz.)

**Western prices slightly higher.*



No. X 226

FINEST RULE! Take direct readings of inside measurements with the *Stanley "100 Plus"* Zig Zag Extension Rule. Slide and rule reading centered at one point. 6′ rule, 8″ slide. $2.75 wherever fine tools are sold.

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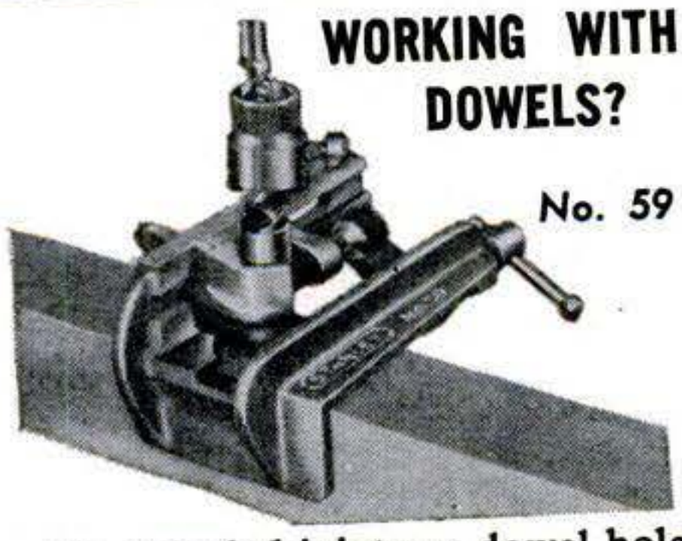
WORKING WITH DOWELS?



No. 59

Do doweled joints or dowel holes give you trouble? Try the *Stanley Doweling Jig*. You'll bore holes of exact accuracy in edge, end or surface of work. You *can't* go wrong (see illustration). $5.75* with 6 different sized guides, wherever fine tools are sold.

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- ☐ Please send me *FREE* "YANKEE" TOOL BOOK Y41.

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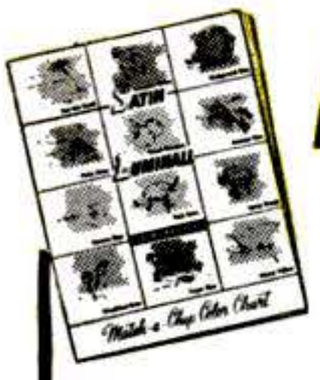

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Luminall Paints

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MILLIONS OF HAPPY USERS KNOW THE LUMINALL LABEL IS THE FINEST GUARANTEE IN PAINTS

Small Nash Is Fast and Fancy

[*Continued from page 109*]

gas after you've run the tank dry or have let the automobile sit for a long time in your garage.

The buyer of a Metropolitan convertible can have either a black or tan top. Top boots and continental spare-tire covers are made in matching colors.

Wheels of both convertibles and hardtops come in Mist Gray, and so does the upper body of all hardtops. But the purchaser can order the rest of the car painted Spruce Green, Canyon Red, Caribbean Blue or Croton Green.

235,000 Viewers Gave Opinions

Fancy is the word for the inside, too. Gold-colored vinyl material covers that rear bench, and a combination of genuine ivory leather, beige nylon, and black-and-yellow-striped Bedford cord plushes up the front seats.

This newest and smallest of the Nashes is the result of a marketing poll taken back in 1950.

You may remember that Nash sent its small, experimental NXI touring the U.S. that year and asked 235,000 viewers how they liked it. Ninety percent liked it fine. Now, after 20 major changes, the hand-built NXI has become the Metropolitan. Though produced in England—to keep costs down, Nash says—the car will be sold only in this country.

Long before 1950, the idea behind this Nash with the 85-inch wheelbase was simmering in the mind of Nash's president, George Mason. Using his motorcycle know-how, Mason started working on the car 11 years ago, conceiving it as a three-wheel, 10-horsepower machine. He stuck with it until it emerged as the first really light car built by a major American auto firm, and the first passenger car engineered in the U. S. and built entirely abroad for sale here. END

Man's Greatest Need

What most of us need is more horsepower and less exhaust.—*Texas & Pacific Topics.*

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SHOP BY MAIL & SAVE — *** GOV'T. *** SURPLUS AND OTHER BARGAINS — MANY ITEMS JUST RELEASED

ALL ITEMS ON THIS PAGE
BRAND NEW

DOUBLE ACTION
HYDRAULIC CYLINDERS

NEW MANUFACTURE

ITEM #224—3¼" bore, 24" stroke, will lift 8250 lbs. with 1000 P.S.I. line pressure. ½" pipe thread ports—1⅜" stress-proof ground, polished & plated solid steel shaft. Overall length closed 36". Ship. Wt. 50 lbs. F.O.B. Chicago . . . **39.60**

ITEM #16-C—1½" bore, 26" stroke. Will lift 1760 lbs. with 1000 lbs. pump pressure. Great for hay loaders, etc. 1" stainless steel piston rod. Postpaid **16.95**

ITEM #355 — 2½" bore — 7½" stroke. Mfgd. by Delco-Remy. Clevis mounting. ⅜" pipe thread ports. Will lift 5000 lbs. F.O.B. Chicago **16.00**

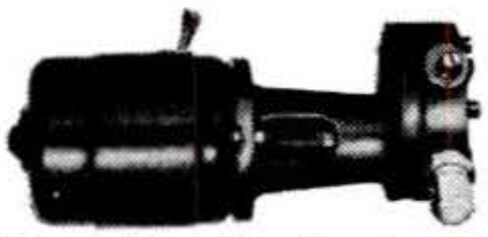
JUST RELEASED!
BLACKHAWK HAND-HYDRAULIC PUMP

ITEM #82. Perfect for Hydraulic Presses, Snow Plows, Farm Wagons, Jacks, and Farm Plows. A few easy strokes of the 20" handle and you can lift 5000 lbs., using Item 355—Hydraulic Cylinder. Blackhawk Model P-151—complete with built-in oil tank and release valve. Rated 1200-8400 lbs. per square inch. Dim. 9"x7"x6". Ship. wt. 35 lbs. Worth much more. F.O.B. Chicago **22.50**

AUTOPULSE
ELECTRIC PUMP

ITEM #117 — rated 24 volts, .6 amps, used as fuel pump for alcohol, gasoline, etc. on boats, trucks, or other equipment having a 24 volt system, ⅛" pipe thread ports, may be changed to a 6 or 12 volt operation by changing or rewinding solenoid. **4.95** Postpaid

THOMPSON
ELECTRIC FUEL PUMP



USES: ● Fuel Transfer ● Coolant pump ● Hydraulic pump ● Oil pump

ITEM #313—12 volt D.C. at 5 amps, direct coupled to positive displacement gear pump with built-in adjustable pressure relief valve. Pump delivers 1 G.P.M. at 100 P.S.I., standard ⅛" pipe thread ports separate outlet port provided for relief valve. Dimensions 7¾" x 2¾" x 4¼". Shipping Weight 8 lbs. F.O.B. Chicago **12.50**

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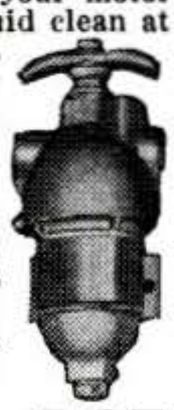
PESCO GEAR TYPE
HYDRAULIC PUMP —Compact—Powerful—Reliable

—ITEM #160—Especially designed for belt drive from fan belt, power take-off, drive pulley, electric motor or small gas engine. Equally suitable for direct coupling. Pedestal type mounting with two bolt holes for ⅜" hold-down bolts. Standard ½" pipe thread inlet and outlet ports. Delivers 4.5 GPM at 1000 PSI at 2800 RPM with 3 HP. Will actuate one item #224, 3¼" bore. 24" stroke cylinder in 10 seconds. Hardened steel gears turn in dense oilite bronze bearings. Rotation — clockwise facing shaft. Guaranteed trouble-free service. Ship. wt. 6 lbs. F.O.B. Chicago **22.50**

ITEM #70
PUROLATOR
OIL FILTER



A perfect permanent element oil filter to keep your motor oil or hydraulic fluid clean at all times. Protect your pump or engine with this unit. Just turn the handle and the element is clean. Standard ⅜" inlet and outlet ports accommodate 16 gallons per minute. Shipping wt. 4 lbs. $13.00 value.

NOW ONLY..... **5.95** Postpaid

ITEM #371V

SAVE $30.30 ON THIS
Brand New—Pesco
HYDRAULIC CONTROL VALVE

FOR SAFE, POSITIVE CONTROL OF HYDRAULIC CYLINDERS AND MOTORS—● BUILT-IN RELIEF VALVE—factory set at 1200 P.S.I. ● FOUR-WAY VALVE—to operate one double acting cylinder ● OPEN CENTER—with valve in neutral, cylinder is locked in position and pump is unloaded. ● SPRING RETURN TO NEUTRAL ● FULLY BALANCED PLUNGER ● EASILY STACKED INTO 2, 3, or 4 valve combinations for multiple cylinder operation. ● 8 gal. per min. capacity, at 1500 P.S.I.,—⅜" pipe ports. ● CONNECT PUSH RODS TO HANDLE FOR REMOTE CONTROL. ● EASY MOUNTING ● LIST PRICE—$46.80. ● YOU SAVE $30.30. ● DIMENSIONS—9"x4½"x2½"—Ship. Wt.—8 lbs. . . . . **16.50** F.O.B. Chicago

VERSATILE
HYDRAULIC CYLINDER

ITEM #41C1C ● 2" Bore ● 6" Stroke ● Double Acting ● All Steel ● ⅜" Pipe thread ports. Lift capacity 3100 lbs. with 1,000 P.S.I. line pressure. Ship. wt. 12 lbs. **Price ea. 12.50** F.O.B. Chicago

HYDRAULIC SPEED REDUCER with FINGERTIP CONTROL

ITEM #115

USE FOR: ● Reamer Drives ● Midget Cars ● Feed Mills ● Canning Machines ● Conveyors ● Lathes ● Milling Machines ● Motor Boats ● Cream Separators ● Garden Tractors ● Pumps

Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of ¼ to 1½ H.P. This Westinghouse-Oil Gear Unit consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Shafts measure ⅝" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speed not to exceed 750 R.P.M. Over-all dimensions, 7½"x7½"x11½". Gov't. acquisition cost $428.00. Shpg. wt. 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago. **54.50**

LIGHTWEIGHT—PORTABLE
GENERATING PLANT

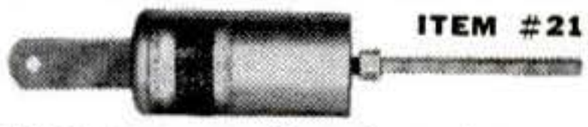
ITEM #351—.3KW—300 Watts—120/240 Volts—2.6/1.3 Amp.—100% Power Factor—60 Cycle AC Single Phase. Electric Motors and Specialty Co. Generator directly connected to a 1 cylinder, 2 cycle, air cooled, rope starting Jacobson Gas Engine; 3600 RPM. Overall dimensions 18-5/16"x14"x10-⅞". Shipping weight 87 lbs. . . . . **79.00** F.O.B. Chicago

AUTOLITE GENERATOR

12 Volts, 15 Amps, Model No. GFU-4105

ITEM #168—Use on farm tractors, marine, truck and industrial engines, for charging 12 volt batteries. 4 bolt flange mounted, center hole to center hole dimensions 3¼", for use with external voltage regulator, removable drive gear, may be replaced by pulley for belt drive. Shipping wt., 14½ lbs. Dimensions, 8½"x4"x6". F.O.B. Chicago **15.00** With Voltage Regulator **18.00**

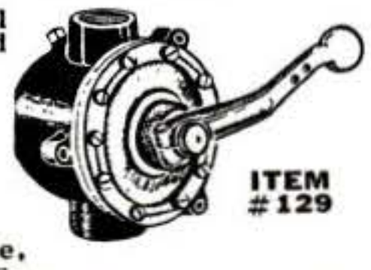
SHOCK ABSORBER



ITEM #21

Brand new, use them to spring suspended vehicles, hoists, pumps, heavy and light machinery, compressors, etc., 11"x2" diameter, welded steel construction for extra strength. Originally used as a gas tank shock absorber for bombers. Shipping weight for 4—11 lbs. . . . . 4 for **5.00** F.O.B. Chicago

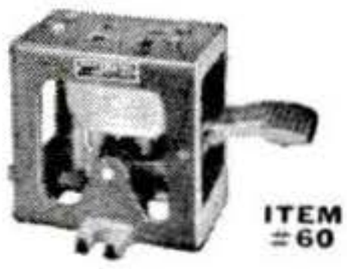
SELF-PRIMING
HAND FLUID PUMP
WITH STRAINER



ITEM #129

Fine general utility hand pump. May be used as a sump pump, barrel pump, fuel transfer pump, for water, oil, gasoline, insecticides, etc. Type D-2—Bronze and aluminum construction, ½ in. pipe thread ports. Capacity—200 Gal. per hour. Ship. wt. 6 lbs. . . . . **11.95** F.O.B. Chicago

ROSS 4-WAY FOOT OPERATED
AIR VALVE



ITEM #60

BRAND NEW—For double-acting pneumatic devices. Fine for operating presses, air vises, air machinery of many types. Heavy duty cast construction. No neutral position. Maintains pressure against the piston when the foot control is in the "Up" position. Threaded for ½" pipe. Dimensions of valve body: 7¾" long x 4¼" width x 7½" high. Net weight 28 lbs. A $64.00 value for only **19.50** F.O.B. Chicago

18" WIRE SPOKE WHEEL

ITEM #57—For use on motorcycle or adaptable for midget cars, trailers, small trucks, any wheeled vehicle. With bearing races and gear. Takes 18" tire. Wt. 19 lbs. A Real Value at . . F.O.B. Chicago **3.95**

FAN MOTOR

ITEM #101—6 V. Fan Motor with double end shaft. Fine for automobile heaters, defrosters, fans, etc. Mfd. by Delco or Redmond. Single wire system. Shaft size ¼" speed 1750 RPM. Weight 2½ lbs. Shipping weight 4 lbs. Dimen. 3" diameter, 6" overall length. Postpaid **2.95**

D. C. GENERATORS

ITEM #91

Type R-1, rated 300 Amps. — 30 Volts. Mfd. by Jack & Heintz. Government Acquisition Cost $380.00. Shpg. wt. 55 lbs. Dimensions 16"x10"x7". F.O.B. Chicago **35.00**

ITEM #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost $300.00. Shpg. wt. 55 lbs. Dimensions 15"x9"x6". F.O.B. Chicago **22.50**

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Supercharger Hops Up '54 Kaiser
[*Continued from page 126*]

in the century, perhaps most notably on the Auburn, Graham-Paige and Cord.

The blower is a pump, plain but not so simple. These pumps are of two types, the Roots, with interlocking rotors (engineers call it the positive-displacement type); and the centrifugal, which throws air off the circumference of a wheel to build up velocity, and therefore volume and pressure.

Neither kind has completely filled the bill for automobiles except, perhaps, for racing cars going at consistently high speed. The Roots type gets out of kilter easily and eats up too much power from the engine. The directly geared centrifugal type has been little good at the lower engine speeds where a motorist does most of his driving. That's because centrifugal force increases as the square of the speed. Too high a blower speed, with too much resulting pressure, causes "ping" or detonation. So the gear ratio between engine and blower on this kind of supercharger has been kept low. That penalized engine performance at low r.p.m. because the blower didn't pump enough air to be effective.

Midget-Car Builder Comes on Scene

All this *was* true. Then along came a fellow named Robert P. McCulloch who, years before, had made a name for himself by building and racing midget cars. He proceeded to make a better supercharger for the ordinary auto engine.

The McCulloch supercharger is different. In fact, at first glance it's cockeyed. McCulloch did away with the complicated gear train that customarily connected the engine crankshaft and the blower. He didn't like gears. They whined. They developed lash.

In their place he put a belt-and-pulley system, plus a sort of planetary-gear system to boost the ratio between crankshaft and blower.

The cockeyed part is that the belt-and-pulley arrangement manages to

[*Continued on page 274*]

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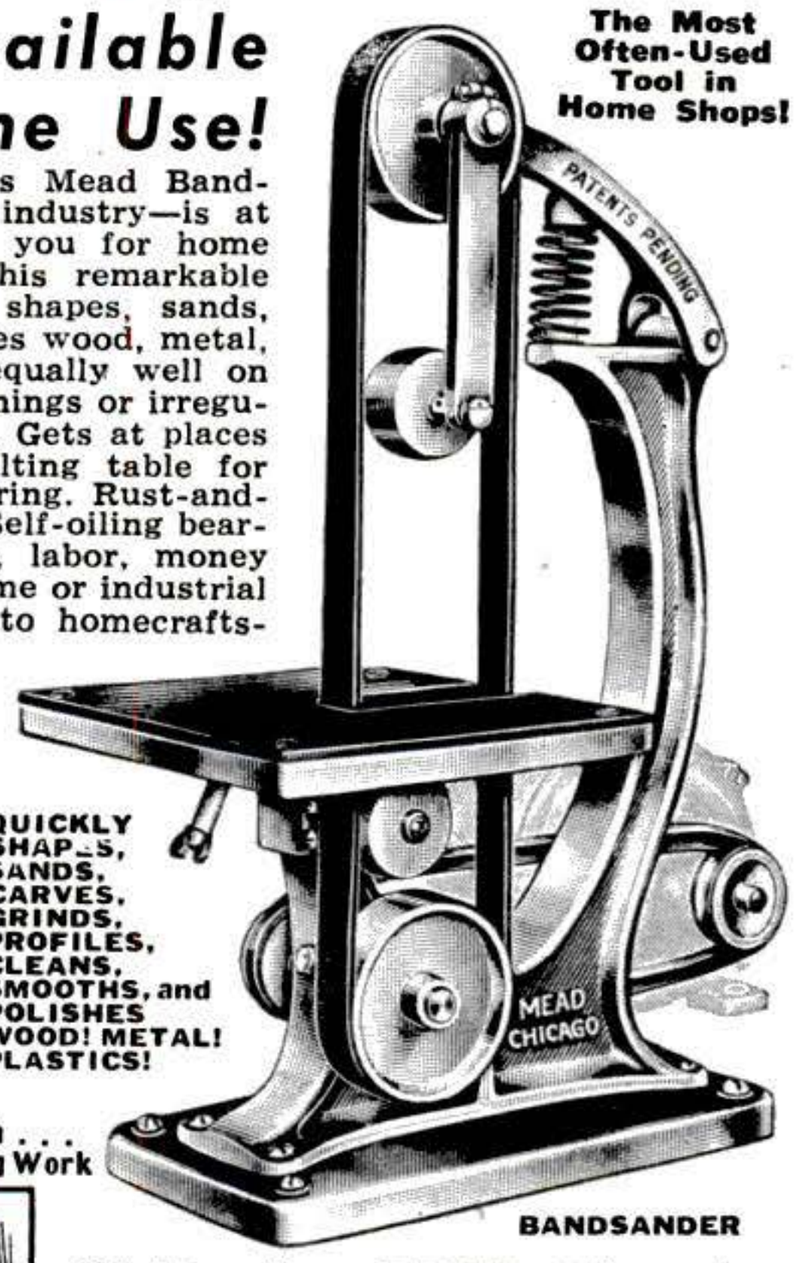
Now Available For Home Use!

The world-famous Mead Bandsander—used by industry—is at last available to you for home workshop use! This remarkable machine quickly shapes, sands, carves and polishes wood, metal, plastics! Works equally well on **inside** cutout openings or irregular outside edges. Gets at places no other can! Tilting table for bevelling, chamfering. Rust-and-sweat proof top. Self-oiling bearings. Saves time, labor, money on jobs in any home or industrial shop. **Invaluable** to homecraftsmen, makers of patterns, tools, dies, signs, costume jewelry, castings, forgings, ornaments, radio and electrical parts, stampings, etc. Nothing else like it. Sold on 5 Day Trial, money back guarantee. Circular Free!

Cuts Fast and Clean . . . Saves Filing, Sanding Work



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Send for the booklet and get the facts . . . then you'll want a Deluxe LEVELALL . . . only $12.95. Better yet, take advantage of our money-back guarantee and order your LEVELALL now. Dealer inquiries welcome.

LEVELALL

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☐Please send free booklet, "On the Level." ☐Mail me Deluxe LEVELALL @ $12.95 ☐Regular 50′ model at $9.95 ☐Ship postpaid full price enclosed. ☐Ship C.O.D.

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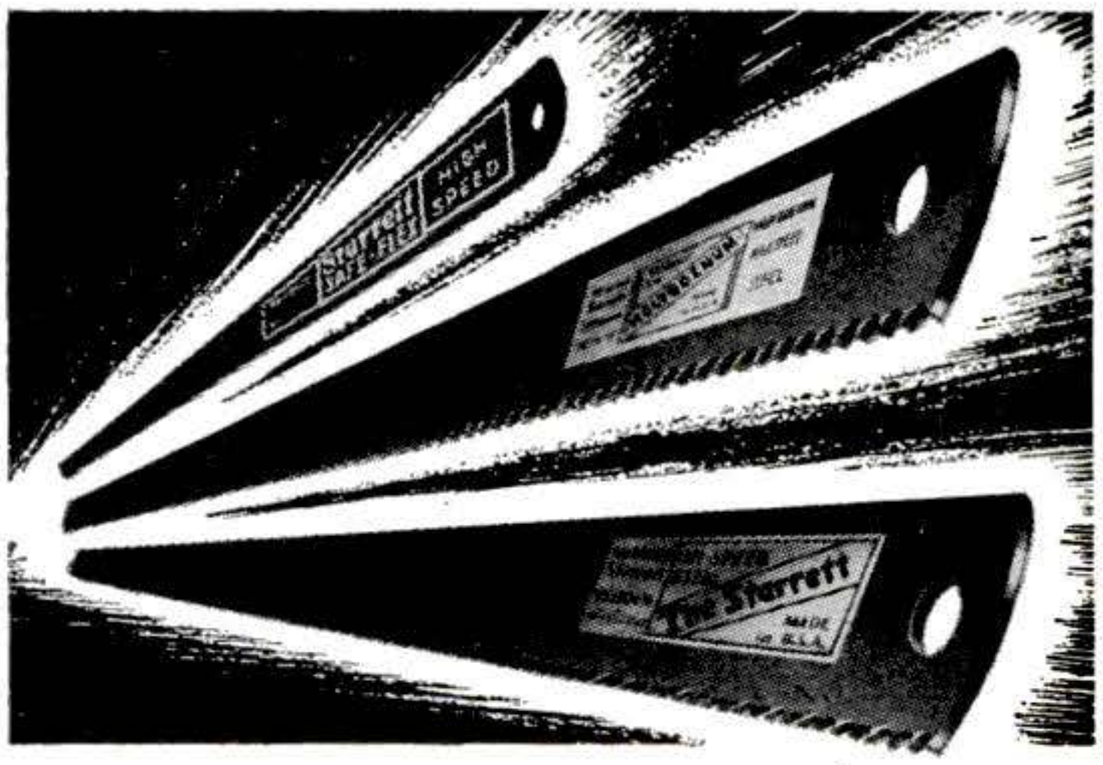

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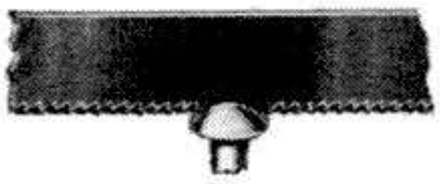

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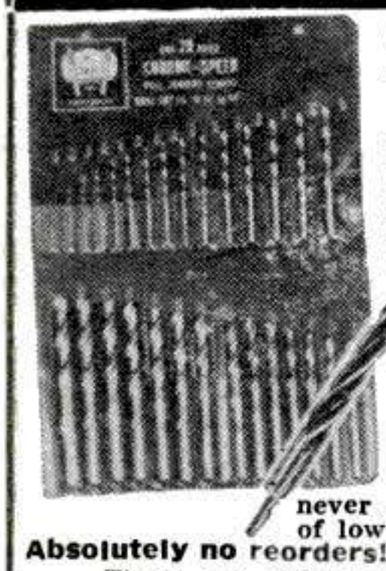


29 PIECE SET TURNED DOWN SHANK SPEED DRILLS $11.95

Hi-Test Chrome specially made for SPEED DRILLING

A $32.95 VALUE! Finest Vanadium chrome alloy steel drills hardened and precision ground to the sharpest, longest-lasting cutting edge obtainable: will easily and cleanly bite through hardwoods, plastics, aluminum, iron, and the toughest steels. **Unconditionally guaranteed** for thousands of drillings. Shanks are full jobber-length, turned down in the larger diameters so that all sizes fit into 1/4" electric drills. Sized by 64ths from 1/16" to 1/2", packed in a sturdy plastic tool roll with individual pockets. This supreme quality set was originally designed to sell for $32.95. Manufacturer's distress has forced close-out of remaining stock at a tremendous sacrifice. When this lot is sold, drills of this quality will never again be offered at anywhere near this unheard of low price. **ORDER NOW WHILE SUPPLY LASTS!! Absolutely no reorders!! Complete 29 pc. Drill Set—$11.95** *postpaid*

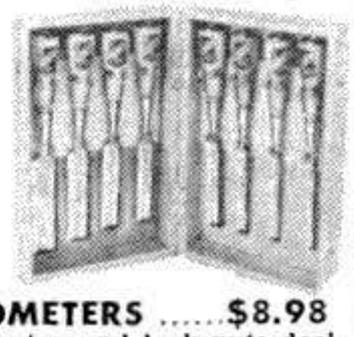
There are also available a very few 15 pc. Sets similar to above 1/16" to 1/2" by 32nds. **$5.95** *postpaid*

Electric Drill CHUCK CONVERTER

Instantly adapt your 1/4" Drill to 1/2" Capacity

Makes your 1 drill do the work of 2. Many more jobs without the expense of an extra drill. Ideal for the home, shop or the factory. Equally useful on hand or electric tools, flexible shafts, etc. Attaches or detaches in a jiffy. COMPLETE—**$1.69** *postpaid*

8 Piece De Luxe Socket Butt Chisel Set



Drop-forged chisels of highest quality tempered and hardened tool steel, beveled and highly polished. Hardwood, leather-tipped handles. Set contains one each, 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1", and 1 1/4" chisel, individually held by two spring clamps, ready for instant use. Beautiful case is of varnished hardwood, dovetail jointed and secured by two brass catches. Measures 11-7/16"x6-9/16"x2 3/4" closed. COMPLETE SET **$7.50** *postpaid.*

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Adjustable with ratchet stop and lock nut; decimal equivalents of fractional sizes diesunk on frame which is recessed for readings in tight spots. Packed in velvet lined case. 0-1", 1/1000 Readings **$8.98** *postpaid*. 1-2", 1/1000 Readings with 1" test gauge **$11.98** *pp.* 0-1", 1/10,000 Readings **$11.98** *pp.* 1-2" 1/10,000 Readings with 1" test gauge **$14.98** *pp.*

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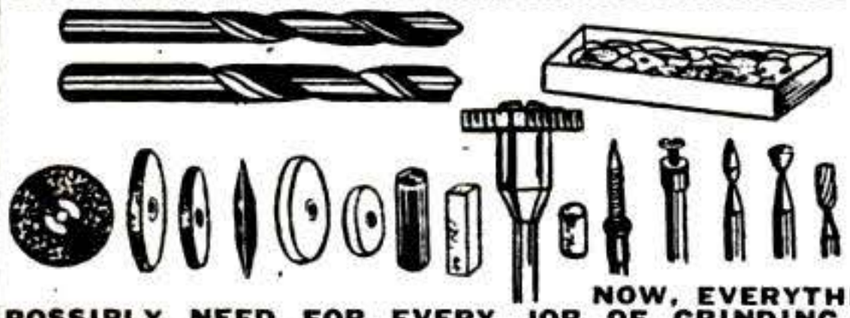

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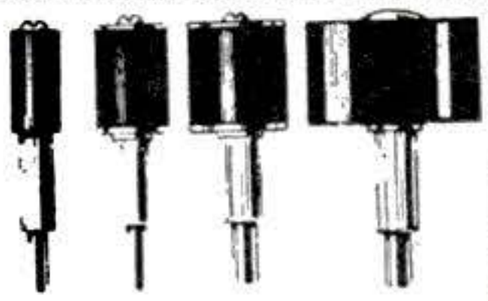
200 useful accessories right at your fingertips. There is more value crowded into this set of quality items than we have ever before been able to offer!! If bought separately these pieces would cost many times as much! Every piece is quality tested and guaranteed to perform the job for which it was designed. We have searched all over the world to bring you this outstanding accessory value.

The complete kit contains—Circular Saws with Mandrels; Mounted Stones; Burrs; Bristle Brushes; Honing Stones; Unmounted Grinding, Rubber, Cut-off and Felt Wheels and Cylinders; Cloth and Paper Sanding Discs; Twist Drills; 2 Mandrels to accommodate the unmounted items. Maximum Shank diameter of this kit is 1/8".

Complete 200 pc. Kit—**$2** *postpaid*

SET OF 4 SANDER DRUMS AND SLEEVES



For smoothing curved surfaces and edges and hard to reach inside corners. Set contains Drums and Matching Sleeves in the following sizes:

1/4" x 1/2"—3/32" Shank
3/8" x 1/2"—3/32" Shank
1/2" x 1/2"—3/32" Shank
3/4" x 1/2"—3/32" Shank

Complete Kit—**$1.69** *postpaid*

SET OF 4 CIRCULAR SAWS AND MANDRELS

Multipurpose saws of 1000 uses. Complete set contains:

1/2" Saw with 1/8" Shank Mandrel
3/4" Saw with 1/8" Shank Mandrel
1 1/4" Saw with 1/8" Shank Mandrel
1 1/2" Saw with 1/8" Shank Mandrel

Complete Saw Set—**$2.50** *postpaid*

CARBIDE-TIPPED MASONRY DRILLS WITH TURNED DOWN SHANKS

The king of stone drills with keen, hardened cutting edges to bite through cement, brick, stone, and the hardest granite. Carbide tip makes drilling easy either by hand or power. Turned down shanks fit all 1/4" electric drill chucks. Set contains a 1/4", 3/8" and 1/2" drill individually packed and unconditionally guaranteed.

3 pc. Set—Value $7.95 **NOW $4.95** *postpaid*

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Supercharger Hops Up '54 Kaiser

[*Continued from page 272*]

"shift gears," thereby changing the crankshaft-blower ratio, and the planetary-gear system, stepping up the ratio, has no gears in it at all.

The engine gets adequate extra air at both low and high speeds. The belt and pulley "shift" to change the ratio for the blower automatically when the engine demands more air—whatever the engine speed. The unit is quiet. It doesn't sap the engine of horsepower. Top cost in gas is about a half-mile per gallon.

There are drawbacks and questions on superchargers. Nobody knows yet whether the added work given an engine in day-to-day, stop-and-go driving will tend to shorten its life. The use of premium fuel is a must. Compressing the air creates heat. That costs some fuel. But in winter it hastens your warmup.

(For other pros and cons on supercharging, see "Blower Adds Zip to the Family Car," PSM, Aug. '51, p. 134.)

Kaiser is also going to change the rear-axle ratio of its new car—the old ratio of 3.31-to-1 sacrificed performance for better gas economy.

Kaiser Wins a Customer

And Kaiser, like most everybody else these days, offers power steering and an automatic drive.

I am one of those guys who pick up oddments of information on everything imaginable from taxi drivers. The other day, riding uptown behind a talkative hackie, I mentioned automobiles.

"I got to get myself a new car," he said to himself like a Hamlet.

"What are you driving now?" I asked.

"A beat-up old Kaiser. And brother, is she beat up! You know what?—I got 75,000 miles on that job. You know what?—I've spent exactly $150 on repairs, just $150. You know what?—I'm going to get me another Kaiser with this here new supercharger." END

NEXT MONTH* Popular Science *will tell you how to leave home and like it: tips on ways to get more for your vacation money.

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GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jackscrew mechanism and handwheel, and all other metal parts (less blade) **$22.95**
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- Cuts to center of 24 inch circle
- Handles stock up to 6 inches thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings: Upper wheel runs on two ⅝" bore Oilite Bronze bearings
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws
- Rigid cast aluminum wheels fully machined ready-to-install. Heavy rubber tires
- Uses standard 78 inch blades up to ⅜ in. wide
- Fully enclosed mechanism for utmost safety

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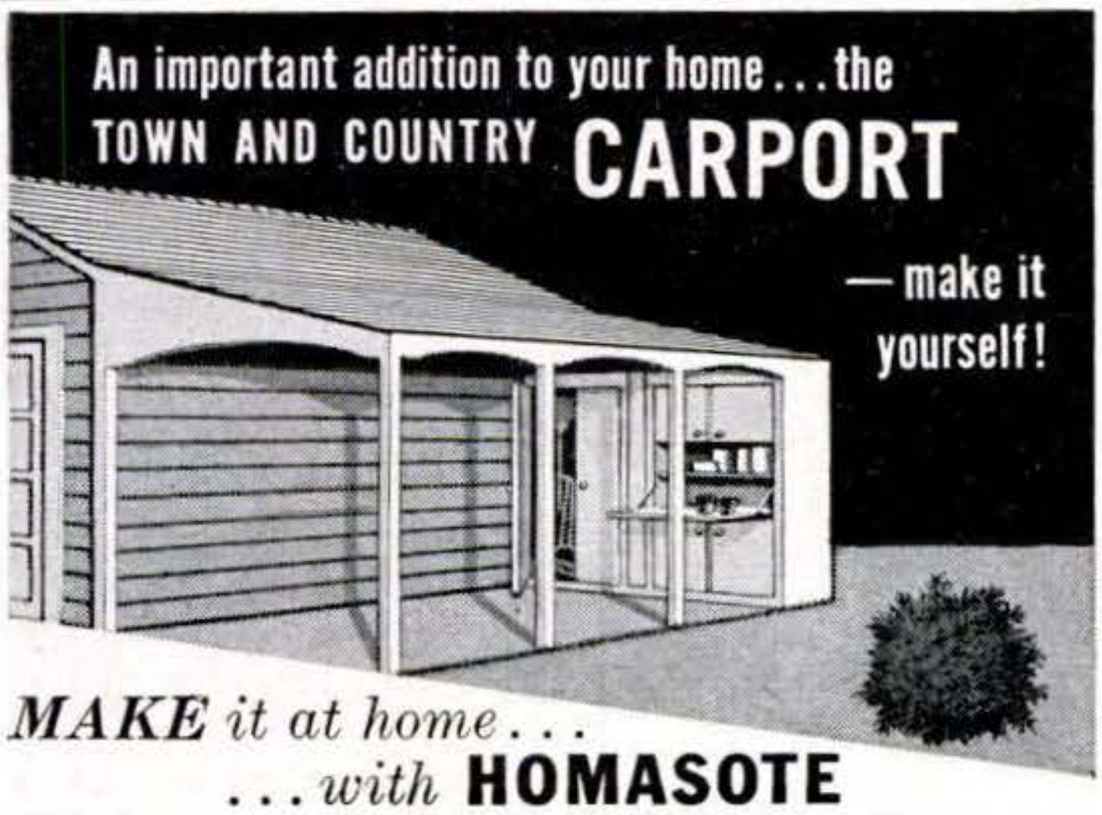

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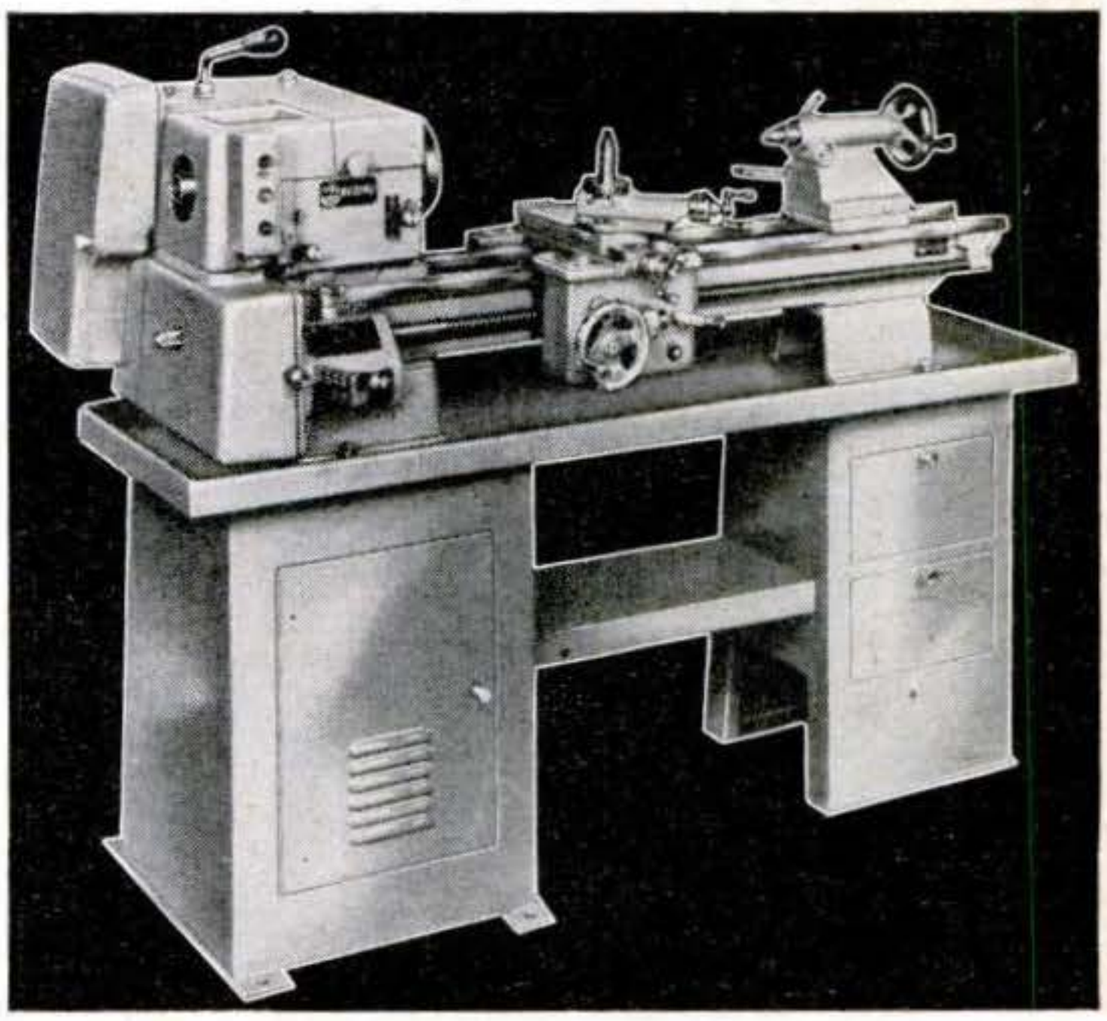

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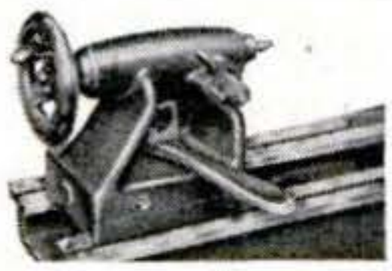
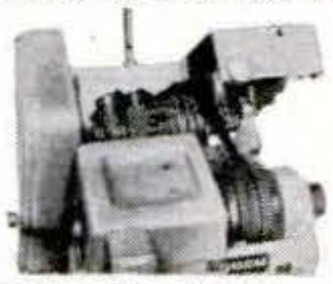
Precision ground, forged steel spindle turns on widely spaced heavy duty Timken "Zero-Precision" tapered roller bearings — bearing run-out tolerance is .00015.



MASSIVE TAILSTOCK
Heavy duty tailstock, No. 3MT ram with tang socket. Swing-type wrench, permanently attached, controls bed lock.



CLUTCH AND BRAKE
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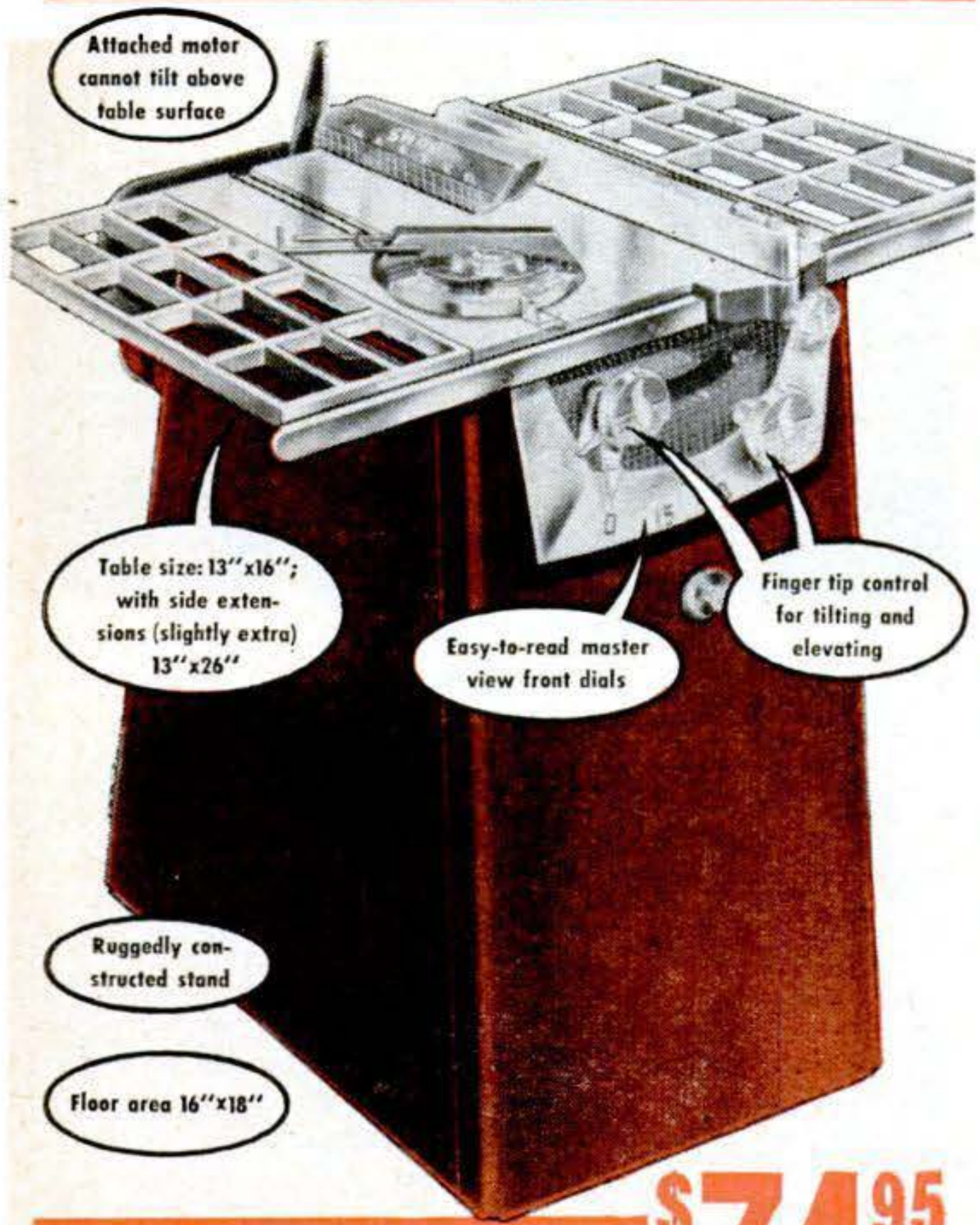

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An Atomic Locomotive Could Be Built

[*Continued from page 140*]

start, as the intense radioactivity makes it virtually impossible.

Is there enough in favor of A-locomotives to offset their complexity and obvious costliness? "The only real incentive for atomic power," says Dr. Borst, "comes from a possible reduction in fuel costs." And here is the score on that point, as he sees it:

An atomic locomotive must be used in heavy-duty service, where its power is fully utilized, to give the highest "equivalent uranium price." To rival a diesel, in a type of service using it only 200 hours monthly, an A-locomotive would have to burn uranium 235 costing no more than $3,000 a pound. But if used 400 hours a month, it could burn $11,000-a-pound uranium 235 and compete with a diesel. And that includes the annual "amortization" charge to repay an investment of $1,200,000 for an atomic X-12, against little more than half as much for a comparable four-unit diesel.

Unofficial Estimate: $9,000 Per Pound

Now, while the AEC isn't telling the cost of producing uranium 235 in its plants at Oak Ridge and elsewhere, it has made enough data public for scientists to arrive at an unofficial estimate. Their calculations indicate the figure to be around $9,000 a pound.

If that figure is anywhere near correct, there seems a reasonable chance that an atom burner like the X-12 will be built. And any future improvements in the AEC production line, lowering the cost of U 235, should make the chances that much better. END

No Argument

THE minister was trying to get an appropriation of $200 for a new chandelier. One man on the church council refused his consent.

"Just why, Henry, do you disapprove?" asked the pastor.

"For two reasons," said Henry. "First, $200 is too much money, and, second, I don't believe there's anyone in our whole congregation that can play a chandelier."—*Northwestern Bell.*

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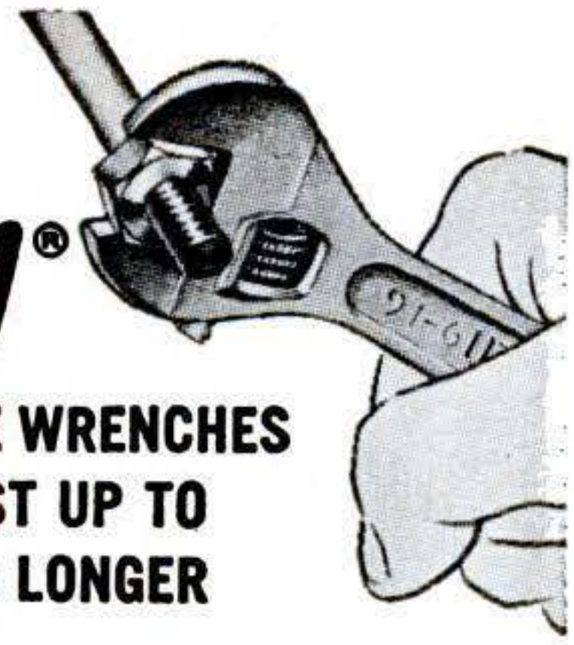

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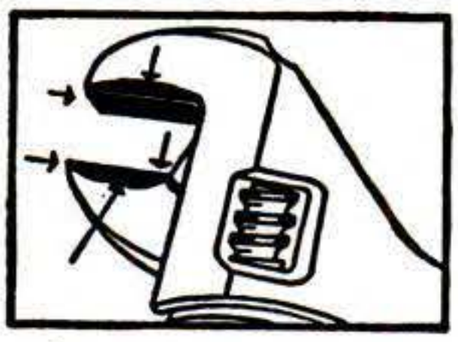

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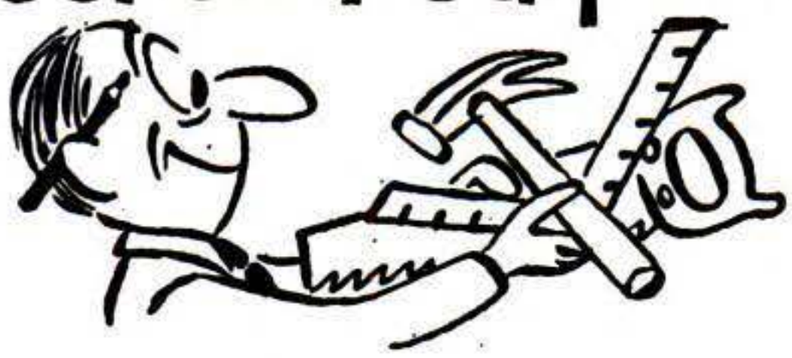

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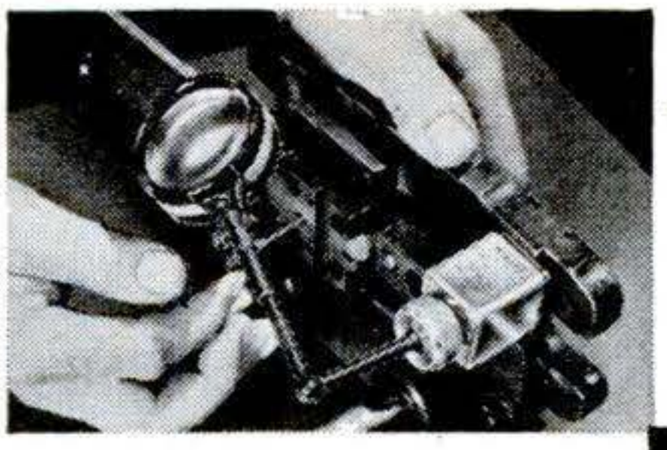

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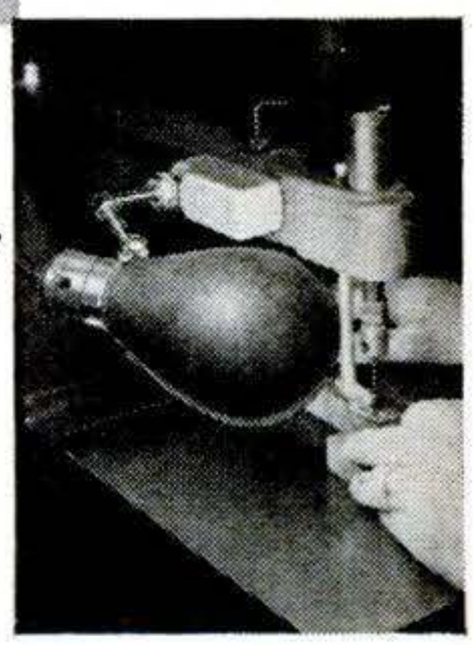

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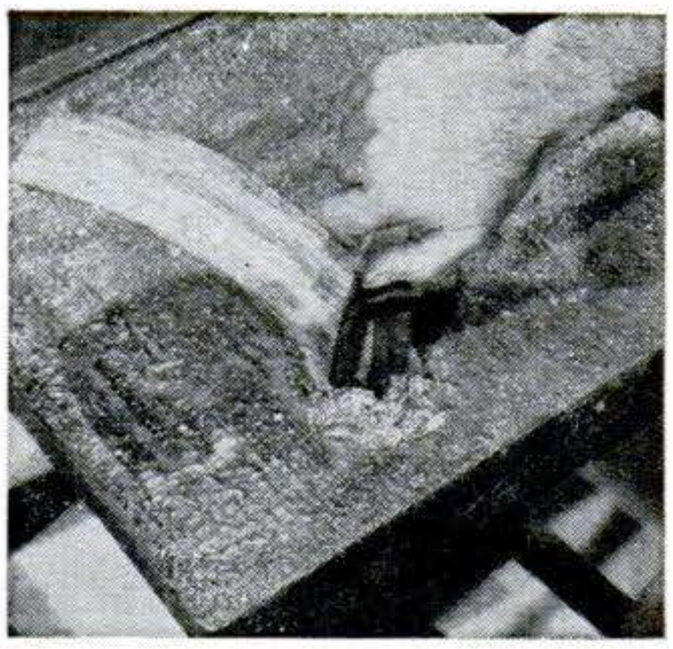
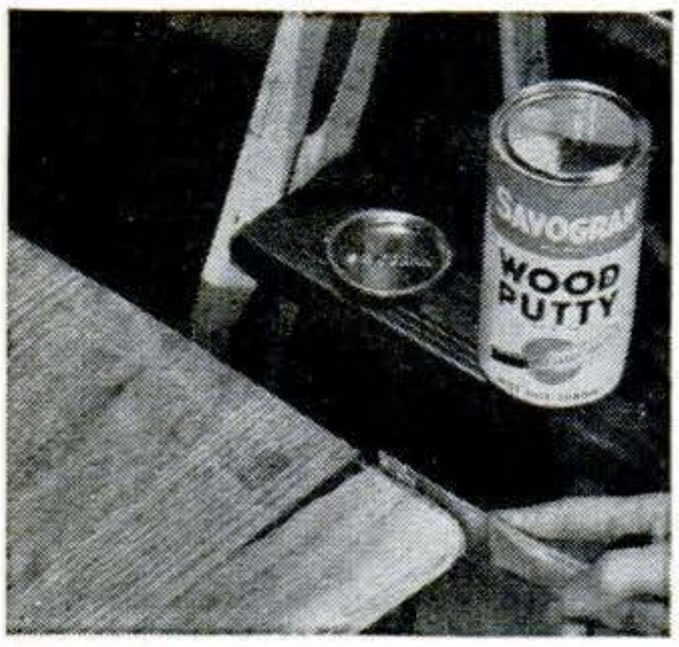
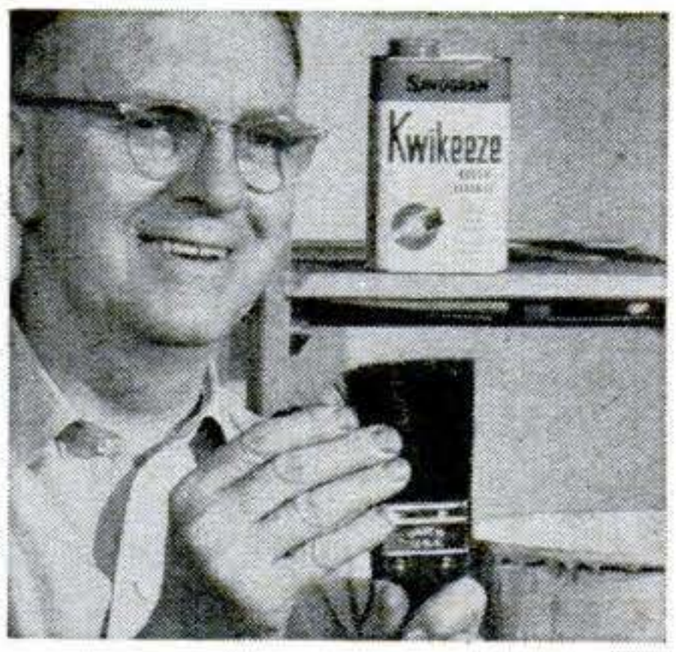
Use These 3 Simple Steps to Get Expert Paint Jobs!



Step 1. *Prepare surface.* Remove all chipped and peeling paint or varnish down to bare wood. Do this by "flowing on" deep-cutting Strypeeze . . . stays wet longer, clings to upright surfaces. Clean off with scraper or #3 steel wool. Won't sting hands. Contains no benzol.



Step 2. *Rebuild broken corners, fill nicks and holes* with Savogran Wood Putty, a powder-form real wood filler. You can form it, tool it . . . and it doesn't shrink. (For cracks in plaster, use Savogran Crack Filler. It's the original patented quick-hardening water putty.)



Step 3. *Start job with clean brushes.* Clean old brushes before painting. Clean all brushes after painting and whenever you change colors. Savogran Kwikeeze, the Liquid Brush Cleaner, softens *hard* brushes in minutes . . . cleans out fresh paint instantly! An excellent deglosser. May be reused.

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He Shifts Gears with Faucets

[*Continued from page 146*]

him. At least he silenced me with a gesture and went on to sketch out the sequence on pages 144 and 145.

With this feedback rig, Banning explains, you get a husky, smooth torque multiplication that can be accurately controlled by the hand valves.

Banning firmly believes that the future of this kind of power application is tremendous. Certainly a lot of military and industrial experts are coming to his unimpressive shop in Zilwaukee. He flatly states that he is in no way interested in producing any form of automobile, and that the sports car he built was made just for fun.

Banning vs. Detroit

To me, the Jeep that he is piloting around Zilwaukee now is the most interesting development of all. Here are no electrical complexities. Banning built this job purely to test out the hydraulic aspects of his idea—to see if his positive-displacement pumps and motors could outperform Detroit's blade-and-impeller converters.

The Jeep is a cadaverous and rather outrageous vehicle. The original engine and transmission are gone. The drive shaft has been sawed off amidships and a chain sprocket welded to the stub end. A motorcycle chain hooks it to another sprocket that protrudes from a big metal box mounted where the rear seat of the Jeep once was.

This metal box looks like a covered minnow tank, with half a dozen or so faucet handles projecting through the lid. The drive shaft from a little air-cooled Kohler engine enters the rear of this tank—and pure, unadulterated torque comes out the other end.

Banning controls this odd craft by twisting a valve now and then. Every time he turned a faucet the Jeep gave me another lusty boot in the back and surged ahead. Engine speed remained constant except when it occasionally slowed because of a stuck carburetor

[*Continued on page 280*]

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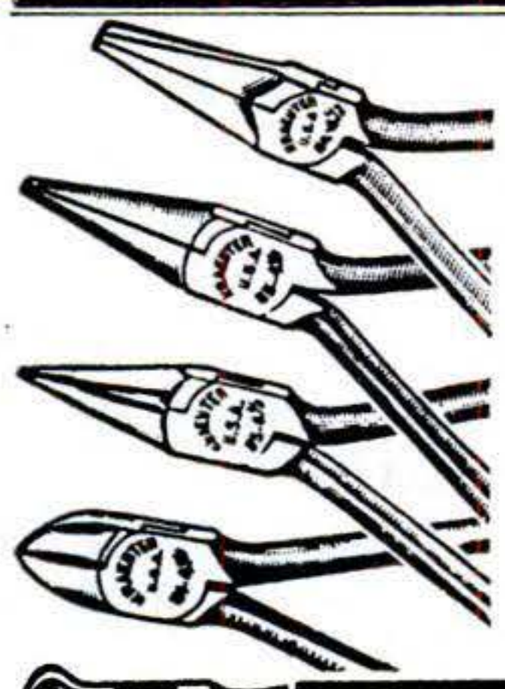

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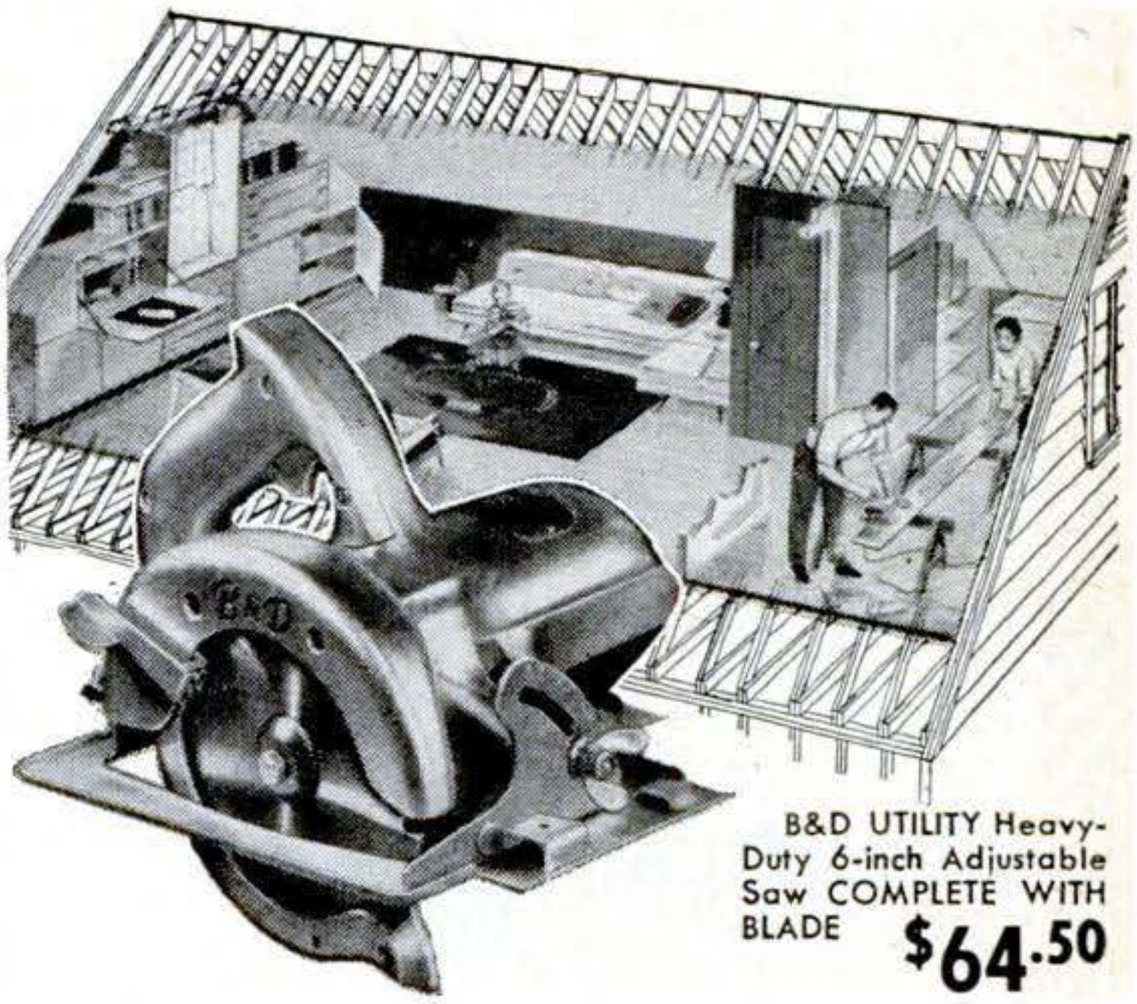

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KLEAN-STRIP IS A 'HARDWARE WEEK' VALUE

He Shifts Gears with Faucets

[Continued from page 278]

float valve. With a genius' fine disdain for details, Banning would then whack the float bowl with a wrench and our tour would continue. You forgot how ludicrous the Jeep looked when you discovered how much beef it had.

From Banning's view, the cockeyed look of the Jeep isn't important. The tank is big because it gives Banning and his men room to get their elbows and wrenches in to make quick changes in the hydraulic gear. The chain drive is just a convenient way of getting power down to the shaft.

As with the Polade Power electric motors, the Jeep works on the principle of torque reaction led back and applied to the load. In this case, though, with no electricity involved, Banning does it differently.

The Wonder "Go-Boxes"

The input shaft from the engine drives a ring gear, much as in an ordinary auto differential. Reaction is transferred to little pinion gears that are coupled to hydraulic pumps. The oil pressure these pumps develop is fed to hydraulic motors linked to the output shaft. The whole lash-up, as I saw it, takes the engine's 44 pound-feet of torque and brutes it up to a potent 240 at stall. This multiplication is entirely without reference to the Jeep's axle ratio or the chain drive.

Even though the idea still seems to me, at times, like a bootstrap deal, Banning is negotiating with some reputable companies for the sale of manufacturing rights. When you ask him about high-torque transmissions for cars, he says he's interested only in licensing manufacturers. But he's sure that some wonder go-boxes are coming. END

Modern Bargain

SHE heard that modern appliances would cut her work in half—so she bought two of each. —*Hudson Newsletter.*

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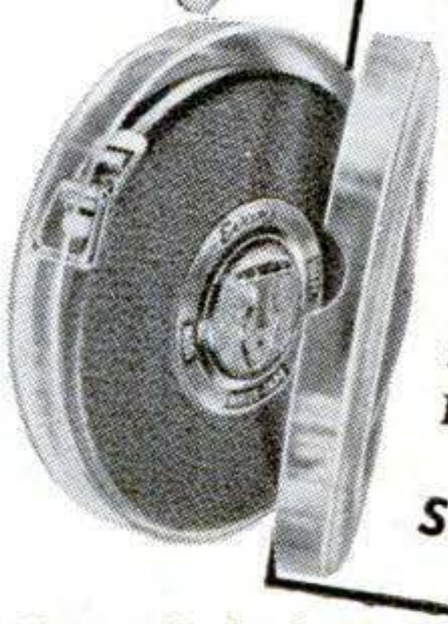

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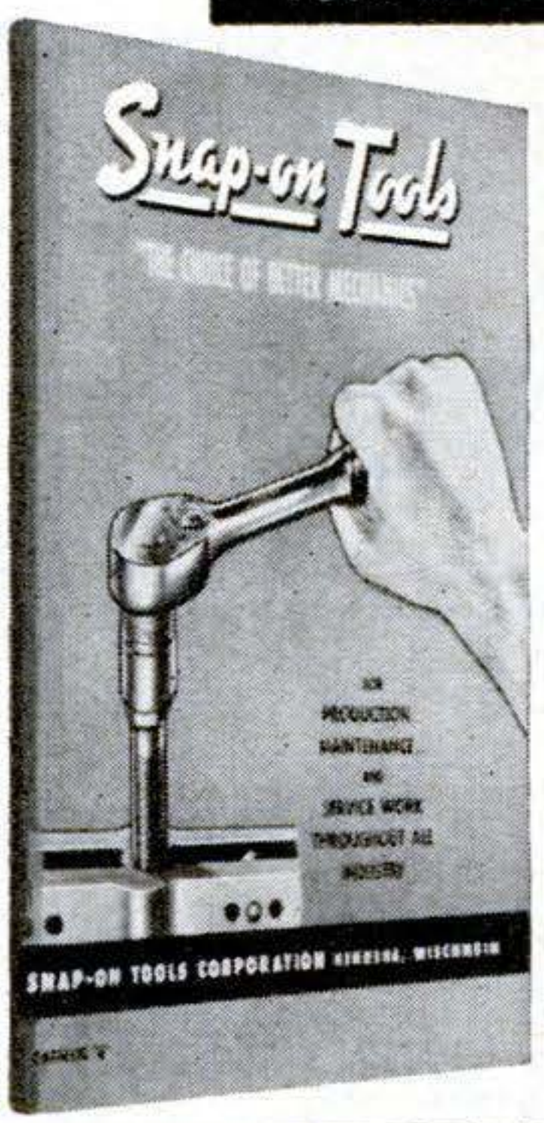

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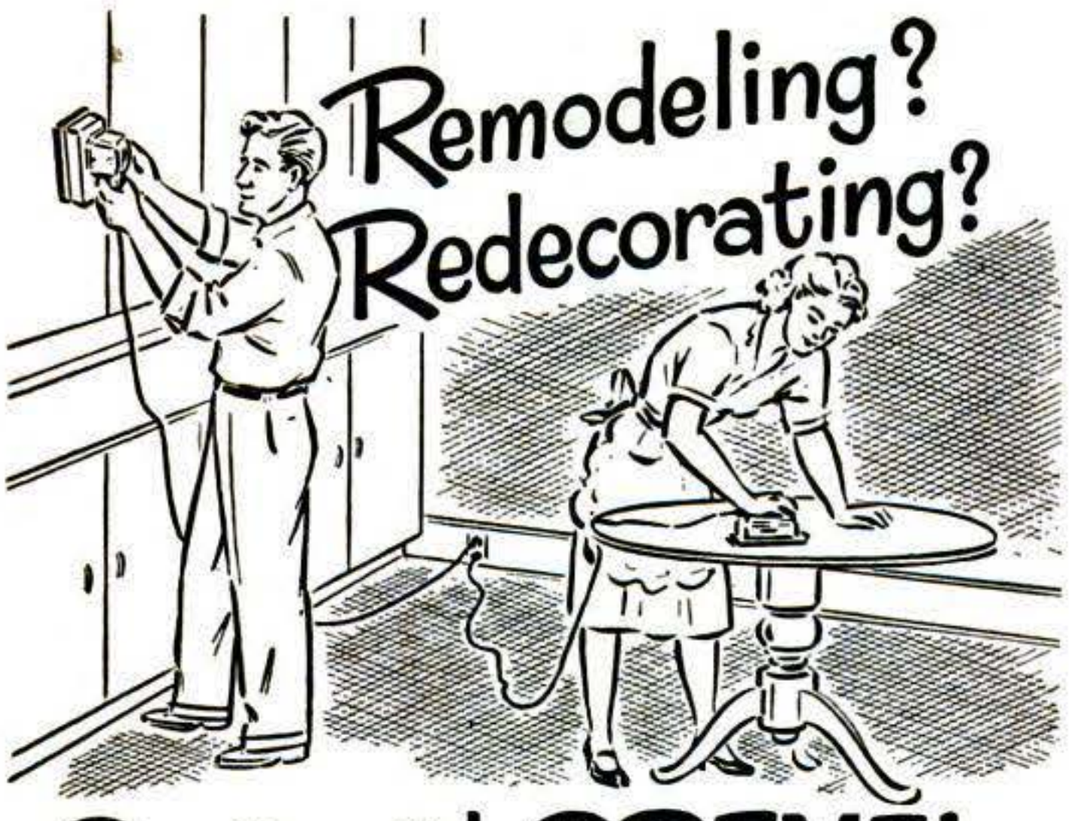

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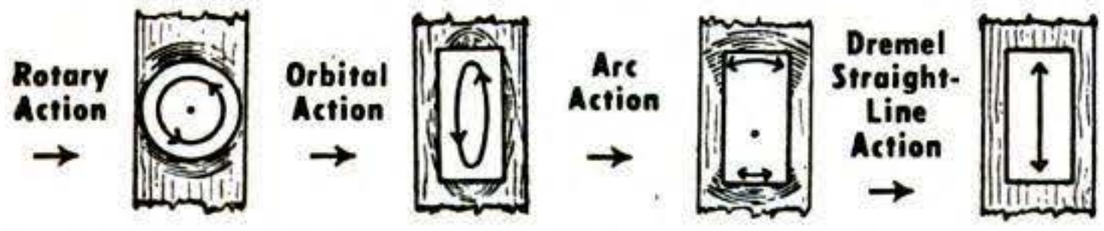

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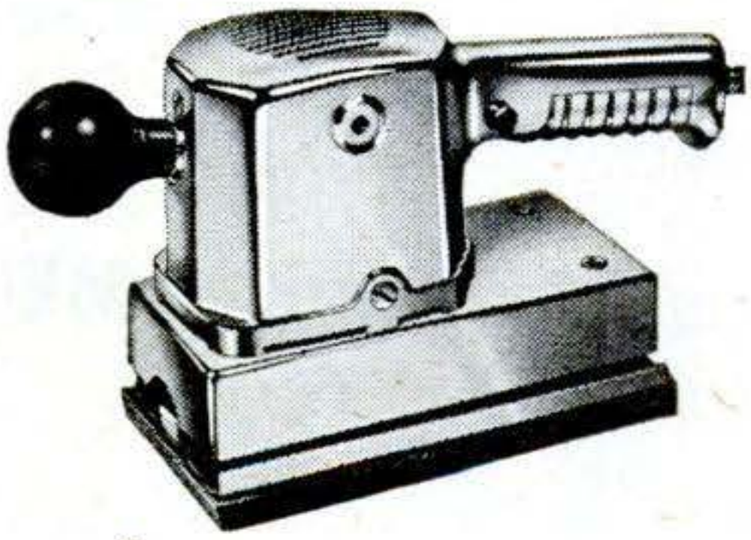

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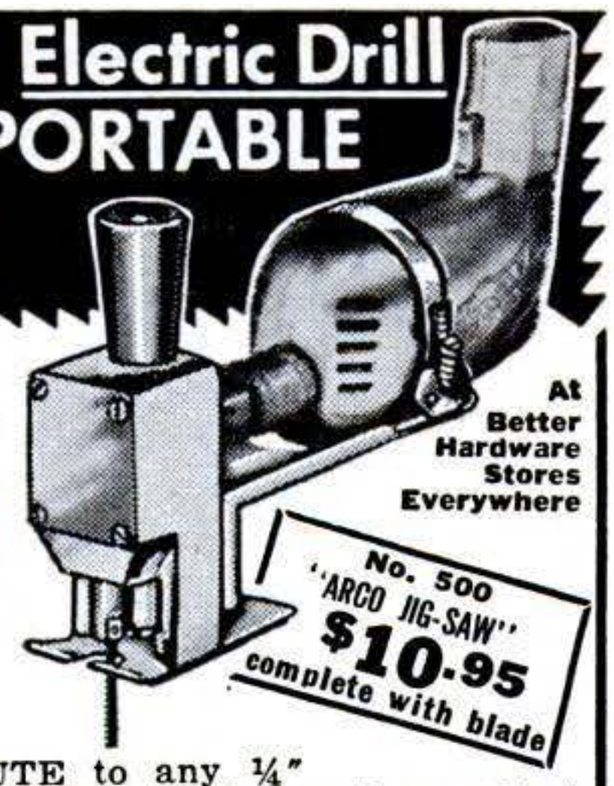

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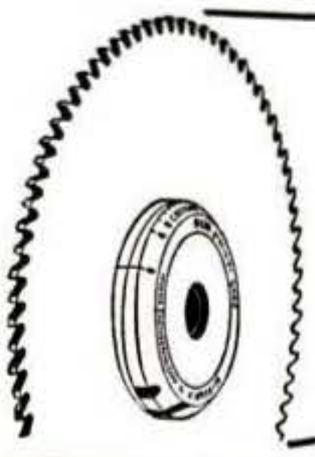

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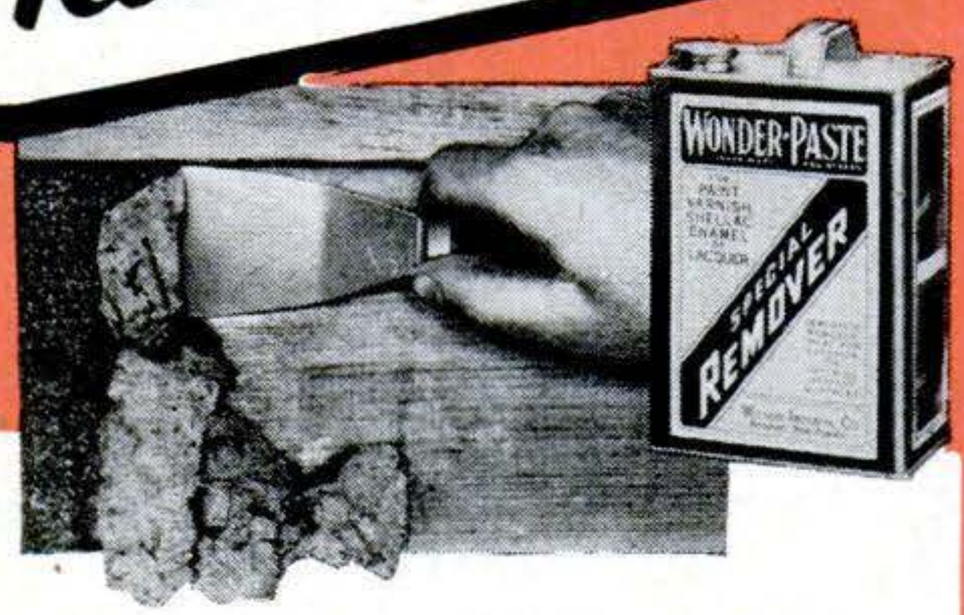

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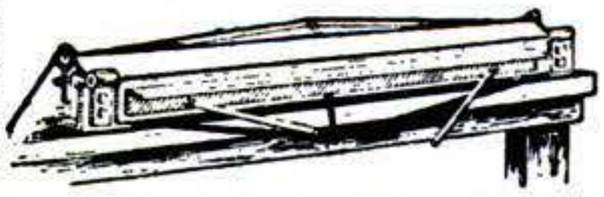

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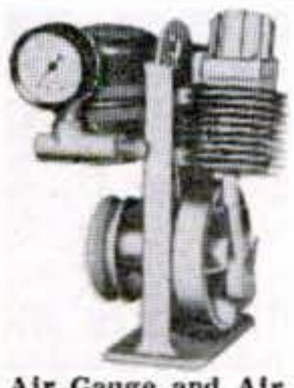

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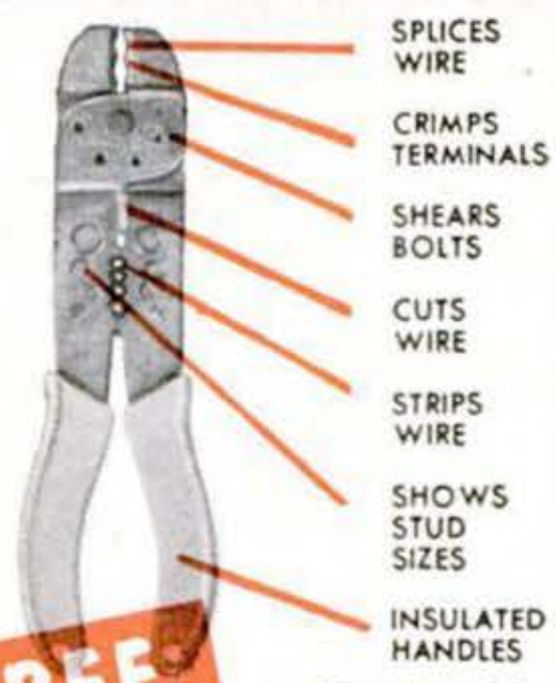

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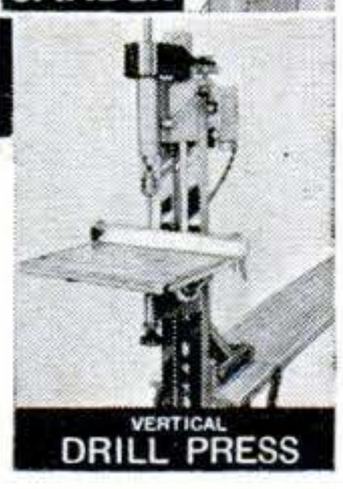

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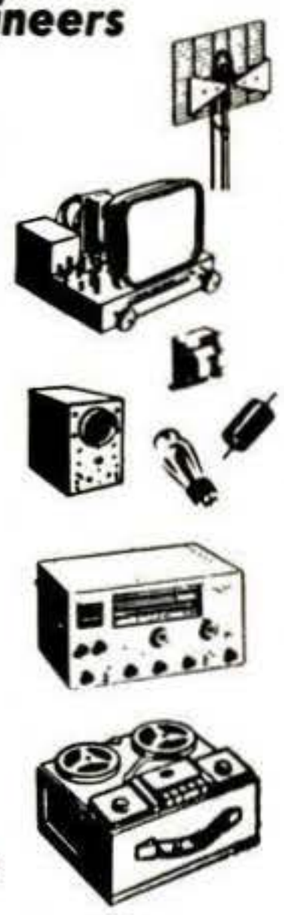

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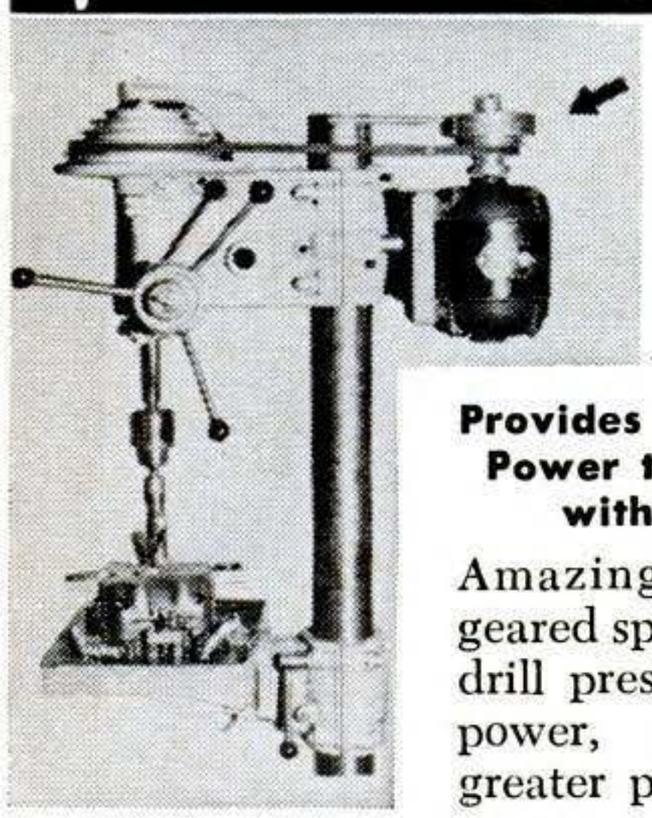

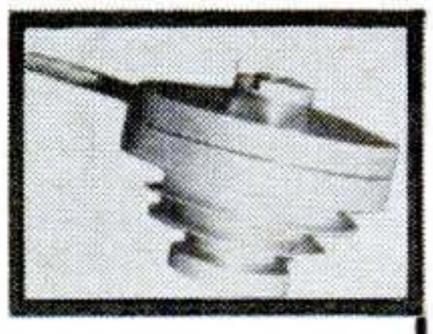

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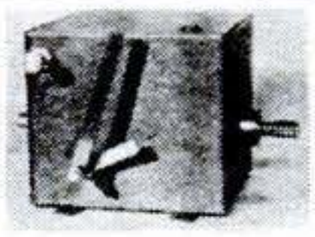

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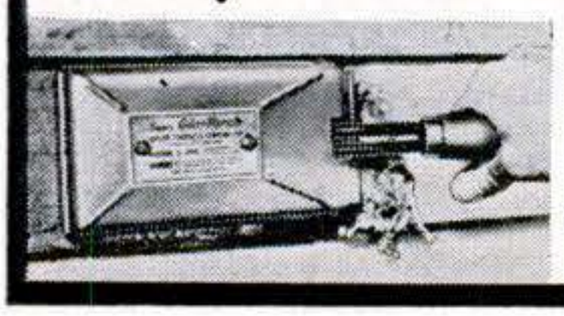

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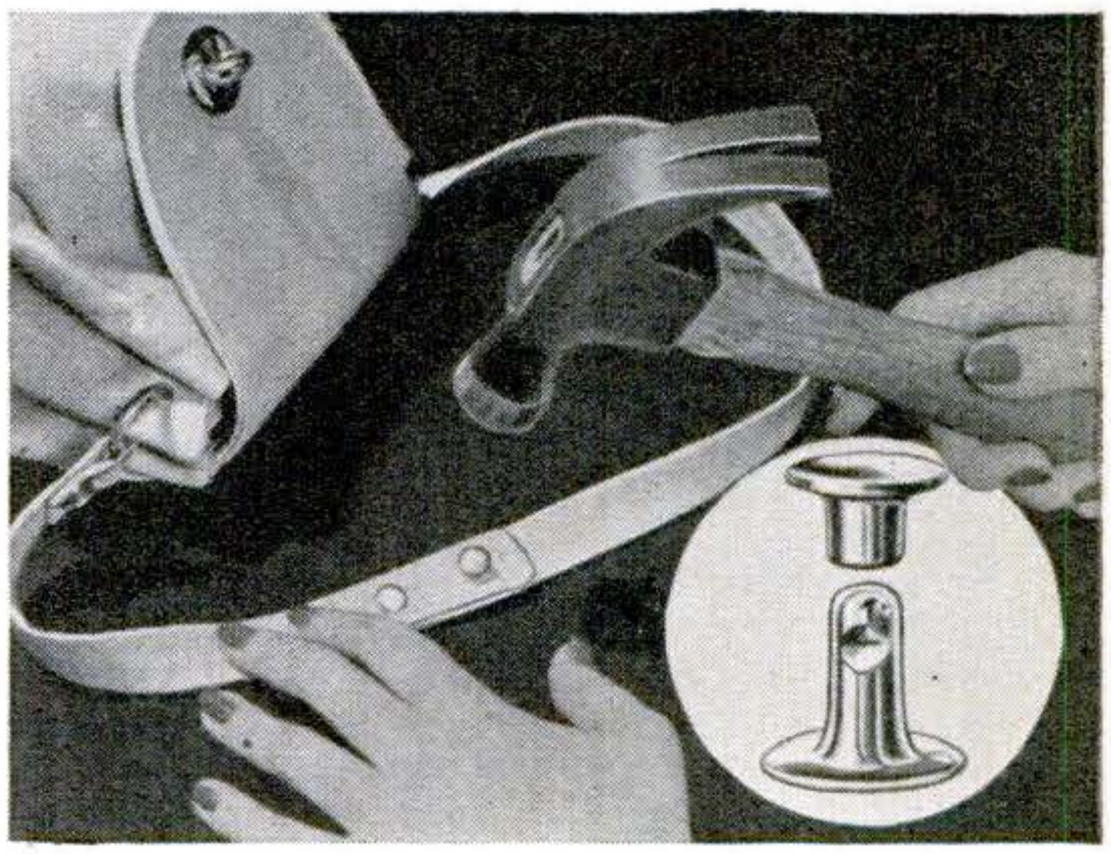

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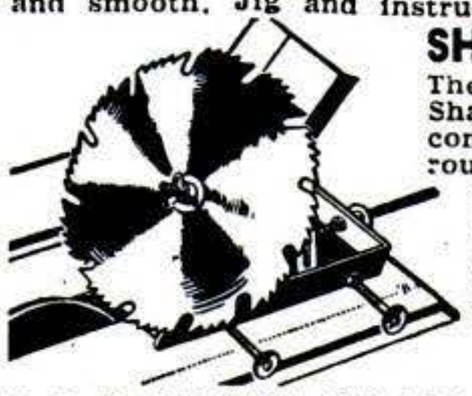

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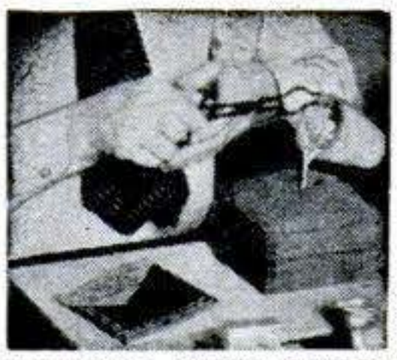

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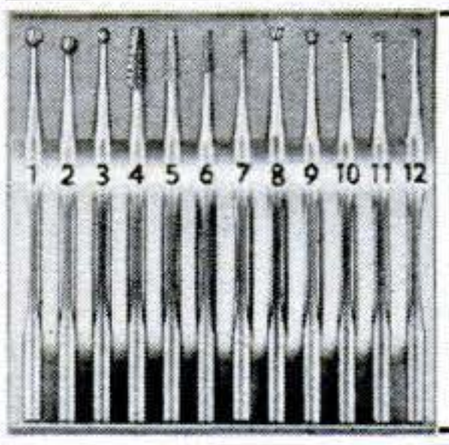

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A strong, form fitting, washable support. Back lacing adjustable. Snaps up in front. Adjustable leg strap. Soft, flat groin pad. No steel or leather bands. Unexcelled for comfort. Also used as after-operation support. Give measure around the lowest part of the abdomen. State right or left side or double. We pay postage except on COD's. PIPER BRACE CO.

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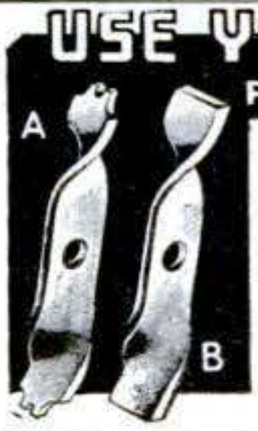
USE YOUR BENCH SAW

FOR JOINTING & CUTTING MOULDINGS



With our six inch tool steel cutters make mouldings, casings, drop-leaf tables, grooves beading and jointing. Moulding cutters, A 1 in. wide $1.75, 1 1/2 in. $2.25. Jointing cutters, B 1 in. $1.75. 1 1/2 in. $2.25. E 1 in. for drop-leaf tables, $1.75. E 1 1/2 in. Makes 3/4 in. cove & Quarter. $2.25. Postpaid. Guaranteed. State size hole. List & Folder free.

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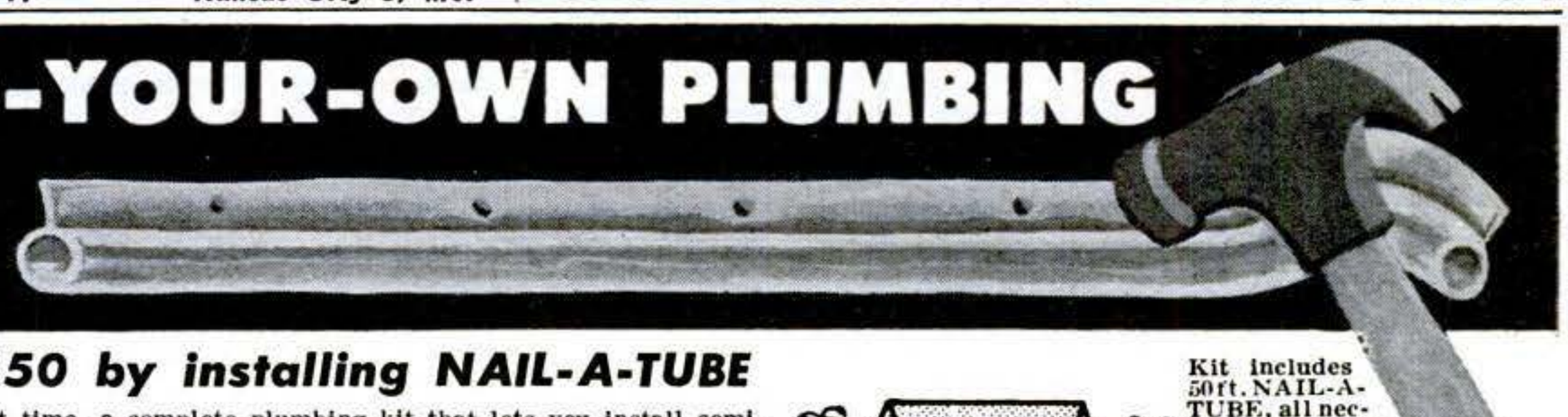
NEW! DO-YOUR-OWN PLUMBING

NAILABLE TUBE



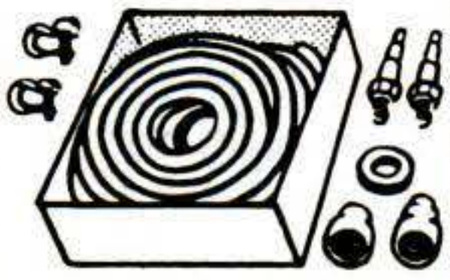
Save up to $50 by installing NAIL-A-TUBE

Now, available for the first time, a complete plumbing kit that lets you install semi-permanent cold water service any place you need it. Running water can now be put in your workshop, den, bar, garage, attic, basement, dark room, chicken-coop, watering trough or barn in less than 1 hour for only $5.95.

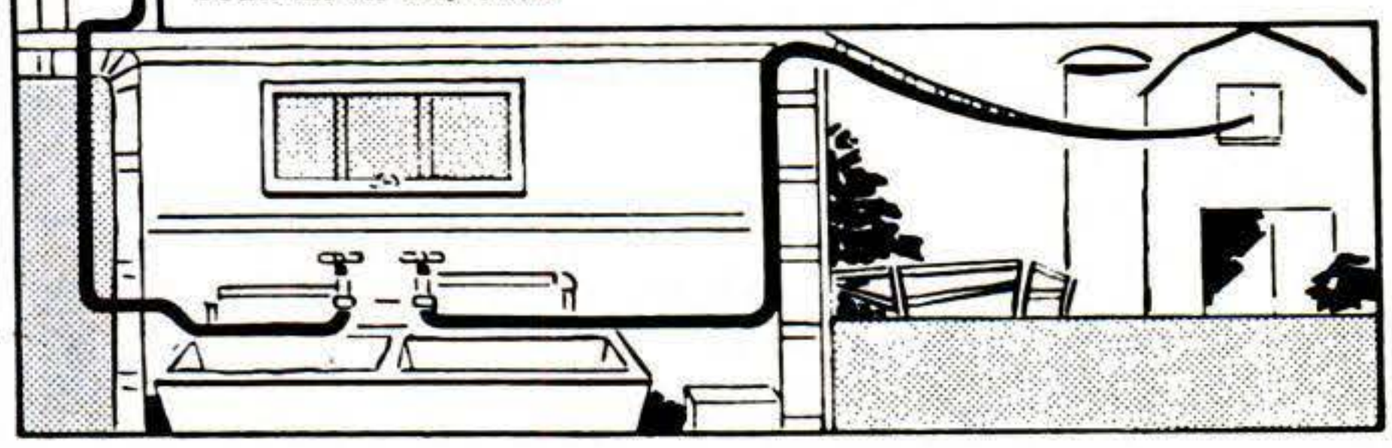
Install a complete automatic drain for your refrigerator, air-conditioner, workshop-sink, dehumidifier or any other appliance without the cost of expensive plumbing.

To install, simply tack specially flanged NAIL-A-TUBE* to the wall, baseboard or ceiling. Fittings connect tube to plumbing. Flexibility lets you install tube in one continuous length regardless of number of corners. No need for cutting, threading, multiple joints, elbows, pipe hangers or special tools with NAIL-A-TUBE.

Frictionless features assure large flow of water. Transparency of tube** will blend with any color scheme, makes tube inconspicuous. For outside uses NAIL-A-TUBE can be suspended between buildings. Light weight makes possible long suspended water lines without extra supports. NAIL-A-TUBE won't break due to freezing water. Don't spend $30 to $50*** for a water connection when you can get the complete NAIL-A-TUBE kit for only $5.95.



Kit includes 50ft. NAIL-A-TUBE, all necessary clamps and fittings to connect to 1/4" and 1/2" pipe and 3/4" garden hose and complete installation instruction. ORDER TODAY on our 7-day money back guarantee. Specify whether you want INDOOR (translucent) or OUTDOOR-INDOOR (black) combination model. *TM & Pat. Pend. **Indoor model. ***Lic. Plumber's estimate. **$5.95**



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Please rush my Nail-A-Tube Kit to:

NAME _____ STREET _____

CITY _____ STATE _____

☐ INDOOR MODEL ☐ INDOOR-OUTDOOR MODEL
☐ SHIP POSTPAID* I ENCLOSE $5.95
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- **CUTS!**
- **BRAZES!**

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For Heavy Work to Lightest Fine Job!

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Tenons • Panels
Routs • Bevels

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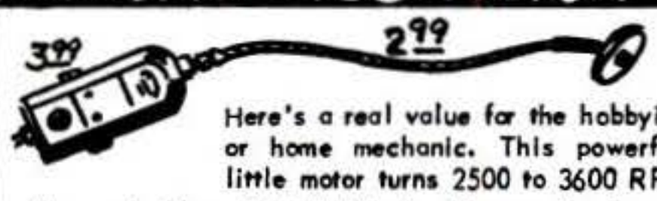
Here's a VALUE UNSURPASSED ANYWHERE! Has a triple objective revolving turret with 3 lenses that will allow 100, 200 or 300 power magnification. All-metal body built to incline through 90°. Built-in micro adjustment. Adjustable sub-stage mirror. Complete in handsome dovetailed hardwood case. Ideal for Lab, student, study of insects, etc.

SPECIAL 9.49

BARGAIN HOBBY MOTOR



Here's a real value for the hobbyist or home mechanic. This powerful little motor turns 2500 to 3600 RPM

Has a double-end shaft fitted with an arbor for mounting small stones, wheels, buffers, etc. and a hand chuck for 3/32" and 1/8" shanks. MOTOR complete with arbor & chuck --- 3.99

FLEXIBLE DRIVE-SHAFT for HOBBY MOTOR 31 inches long and complete with necessary adapters to take, grinding, buffing, polishing, wheel, etc. Shaft is 7/32" dia. Makes this motor a very versatile bench tool. 2.99

DRILL KIT

Hi-Speed-Hi-Test Chrome Steel Drills at LESS THAN WHOLESALE PRICES! Sizes from 1/16" to 1/2" in 64ths. This set of TOP QUALITY Twist Drills has been advertised elsewhere for $34.95. We offer them in machine or jobbers lengths. 9.95

FAMOUS SURPLUS MIXES

Palley HOSE CLAMP MIX - 24 Assorted size clamps - all of the finest aircraft quality. Ideal for use on auto, truck, tractors, boats, planes, etc. Don't be without this amazing War Surplus Bargain. 2.89

GADGET MIX - Another SURPLUS BARGAIN! This amazing mix includes a 'TREASURE' of small parts such as; Cogs, Worm Gears, Wheel Bearings, Rivets, Spacers, Bolts, Screws, Springs and Clamps. 5 pounds for ONLY 1.19

MARCHING COMPASS

Lensatic type. An all-purpose precision instrument for surveyors, hunters, sportsmen, boy scouts, hikers, etc. Can be used for map orientation, taking azimuth reading or as a guide in unfamiliar terrain. The bezel ring is marked in 3° notches for computation and rotates through 360 degrees. Has a special "peep" sight and hair-line guide in lid for taking a bearing on a distant landmark or object, ... 3.95

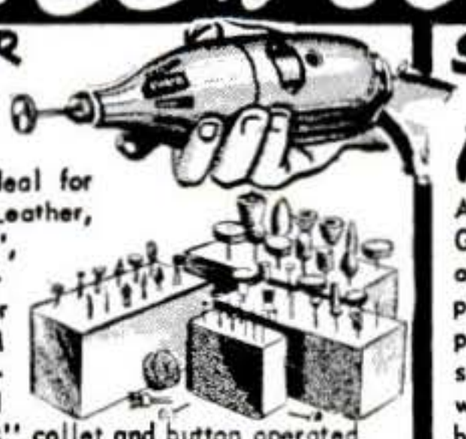
NAVIGATORS MAGNETIC COMPASS

British Navy Type P-11. Like New. Has a rotating verge ring, calibrated in 1 degree increments from 0 to 360°. Two parallel grid wires for N-S and E-W line alignment. Ideal for small boats. 9.95

NAVY OCTANT

Made for the U.S.Navy by the Pioneer Instrument Co. Type Mark 4. Designed for use in aerial navigation. May also be used on land or ocean. Has artificial horizon, dual prism, 4 filters, astigmatizer lens and many other valuable parts. The parts alone are worth many times the price. Will give accurate calculations in sighting Sun, Moon and Stars. In original hardwood case 37.50

200 Pc. POWER TOOL SET



Drills, Buffs, Polishes, Grinds, Engraves, Carves and many other uses. Ideal for Wood, Metal, Plastic, Leather, etc. Powered by a "Duro", universal motor, streamlined to fit the hand. Motor operates at 20,000 RPM on 110 volt AC or DC current. Has fully sealed ball bearings, a 3/32" and 1/8" collet and button operated chuck lock. This amazing combination offer includes 5 COMPLETE SETS of mounted stones, metal burrs, polishing brushes, discs, drills, felt wheels. 200 PIECES IN ALL 19.98

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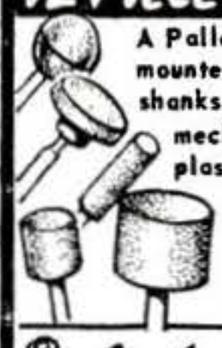
Every Hobbyist, Model Maker, Lab Worker, etc. will want this. Kit contains 1 Hobby Hammer with brass head, 2 inspection mirrors with detachable handle, 2 surgical hemostat clamps, 2 scalpels in case, 2 tweezers, 2 shaping tools & a Palley MYSTERY Special Item ONLY 5.99

12 PIECE MOUNTED STONE SET



A Palley Bargain worth $8.00. Has 12 mounted wheels and points on 1/8" shanks. Ideal for the hobbyist, home mechanic, etc. For grinding on plastic, wood, soft and hard metal. Don't miss this unusual value at only . . . Only 2.29

24 Pc. STEEL CUTTER SET

For mechanic die maker, home workshop, etc. Assorted size cutters on 3/32" long shank. Designed to fit all hand grinders. Ideal for cutting plastic, metal or wood. All new. This $20.00 Value complete in handy plastic case. 6.95

DIVING EQUIPMENT

NEW SELF CONTAINED DIVING UNIT

The new improved Sport Diver is designed exclusively for the underwater swimmer and diver. Allows up to one hour under water. This is a completely equiped unit consisting of a high pressure air flask, valve, pressure reducing regulator, breathing tube, demand regulator, mouthpiece and harness. The air flask can be refilled by most dealers of welding and cutting gasses. Recommended for depths down to 30 feet. ALL NEW! 79.95

NEW CO2 NEPTUNE HARPOON GUN

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Has JET POWER - Simplest, most effective underwater gun. Made for one arm use. Weighs only 27 ozs. Has 150 lb. nylon line on snag-proof line reel. Positive safety catch. Rust resistant finish on all metal body.

CO2 CHARGES - Box of 10 charges for above gun. ONLY 98¢

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Amazing New FIBERGLASS! Guaranteed to PROTECT and WATERPROOF your boat up to 10 YEARS if applied according to our instructions. Fiberglass will permanently protect decks, cabins, bottoms on any size boat. Stops leaky seams, rotted planks, boat worms. These amazing kits specially prepared for us by nationally known Stanford's Fiberglass Co. Each kit contains a special process resin, fiberglass, brush, squeege and complete instructions for use.

- KITS TO COVER BOAT BOTTOMS -

8 ft boat	$14.95	14 ft. boat	$34.95
10 ft. "	24.95	16 ft. "	36.50
12 ft. "	26.50	18 ft. "	44.50

Also available - Kits to cover bottom, sides and transom. Sizes same as above. Write for prices.

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Ideal for mending or patching Boats, Trailers, Station Wagons, etc. . 2.95

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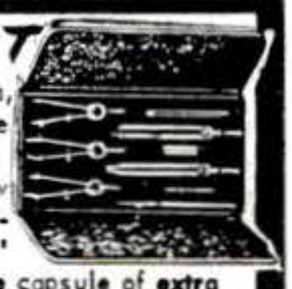
AVIATORS (AN-6530)

WINDPROOF GOGGLES

Genuine Army type. Have interchangeable, precision ground lenses. Your choice of 3 lens colors - Clear, Amber or Green. Metal frames are rubber covered with soft, chamois lining and have built-in, non-fogging breathers. Also has adjustable nose bar. 2.79

EXTRA LENSES - Choice of colors above. Price per pair . . 1.39

9 Pc. DRAWING KIT



Suitable for architect, draftsman, artist, student, etc. Has 9 separate pieces - one 5½" divider; one each 3¼" bow divider, bow pencil and bow pen with wheel adjustment and reversible needle point; one 4-1/4" ruling pen with an extra handle; one capsule of extra lead. All of these quality instruments are contained in a two flap, velvet lined case. 5.98

ARMY RIFLESCOPE 9.95

Built to rigid Gov't specifications. Contains the finest precision, Achromatic optics. Has five double-element lenses, fully corrected for color and spherical abberation. 3 power magnification. Dot reticle. Length 9".

7 TO 1 HANDY HOIST

Strongest hoist for its weight on the market. Will LIFT 1000 lbs. but weighs only 1 lb. Handy at home, on farm, in shop, etc. Consists of 2 pulley blocks, 100 feet of Nylon Cord, 2 Nylon slings and canvas bag. Easy to pack and carry. Ideal as hunters game hoist. Only 12.50

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How Much Did You Learn?

By Sanford E. Taylor and Helen Frackenpohl

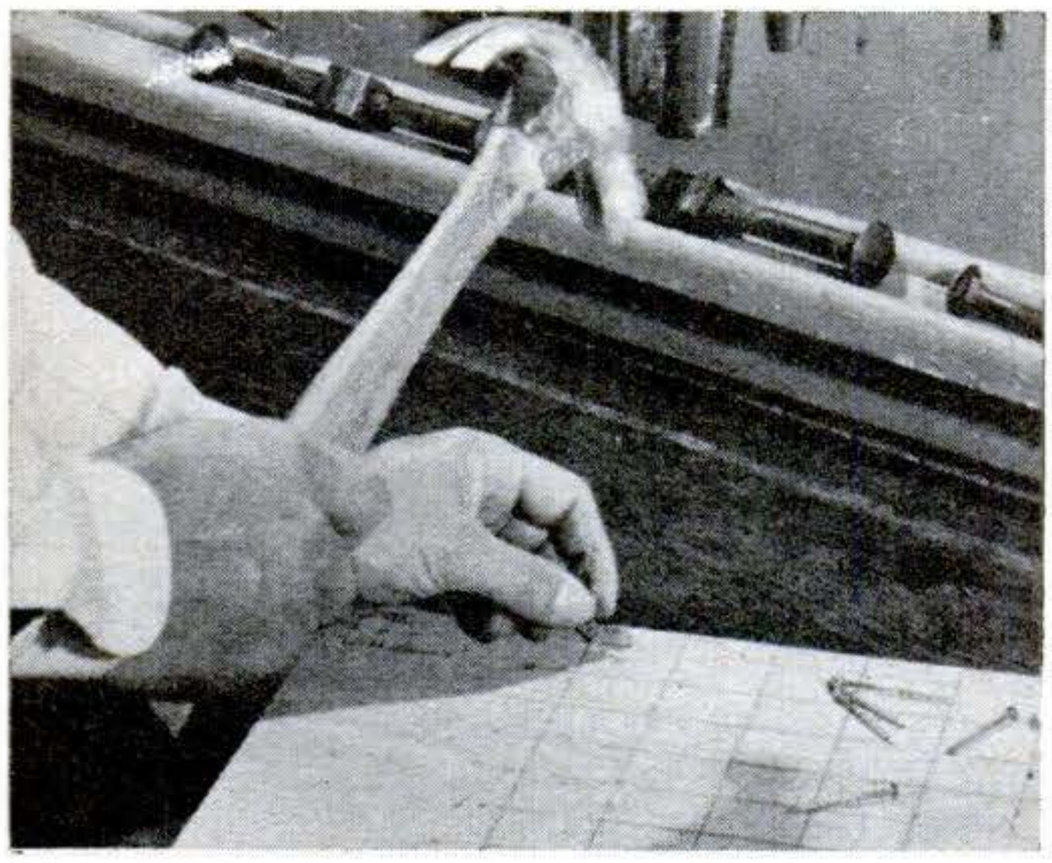
Washington Square Reading Center, New York

Now you can sample how much you remember of the useful and interesting information packed into this issue of POPULAR SCIENCE MONTHLY. Answers to the questions are printed just below the quiz. After each answer is a page reference to the article on which the question was based.

1. *Kaiser upped its Manhattan 22 horsepower with a factory-installed supercharger of the*

a. Roots type
b. McCulloch type
c. centrifugal type

2. *These hands are*



a. building a hi-fi cabinet
b. testing nails
c. designing a new parlor game

3. *Tiny cameras have one big advantage over larger models:*

a. unobtrusiveness
b. simplified operation
c. less darkroom work

4. *The insecticides, OMPA and Systox,*

a. form a deadly film on upper plant surfaces
b. condense on the lower sides of leaves
c. impregnate the entire plant

5. *The recently designed atomic locomotive would burn*

a. liquid fuel
b. uranium sealed in aluminum cans
c. irradiated anthracite

6. *Fishermen giving their reels a spring tune-up should remember this general rule:*

a. grease on gears, oil on bearings
b. oil on gears, grease on bearings
c. grease on all moving parts

7. *The makers of the famous Louisville Sluggers produce*

a. 6,000,000 bats a year
b. 3,000,000 bats a year
c. 1,000,000 bats a year

8. *Oregon highway planners have gone into small-scale model building on a large scale primarily to*

a. catch errors in design
b. help in routing and regulating traffic
c. aid in area planning and landscaping

9. *The first passenger car engineered in the U. S. for sale here, but built abroad, is the*

a. Vanguard Cadet
b. Nash Rambler
c. Nash Metropolitan

10. *The Makalu climbers hope for a tough ascent, because they are studying the effects of*

a. cosmic rays
b. stress
c. discouragement

Answers: 1. b—p. 124; 2. b—p. 174; 3. a—p. 194; 4. c—p. 114; 5. a—p. 137; 6. a—p. 219; 7. b—p. 132; 8. a—p. 183; 9. c—p. 106; 10. b—p. 97.

Coming Next Month—

MECHANICS: How farm tractors are tested.

AUTOS: How to install your own power brakes.

HOMEBUILDING: How to make wood last longer.

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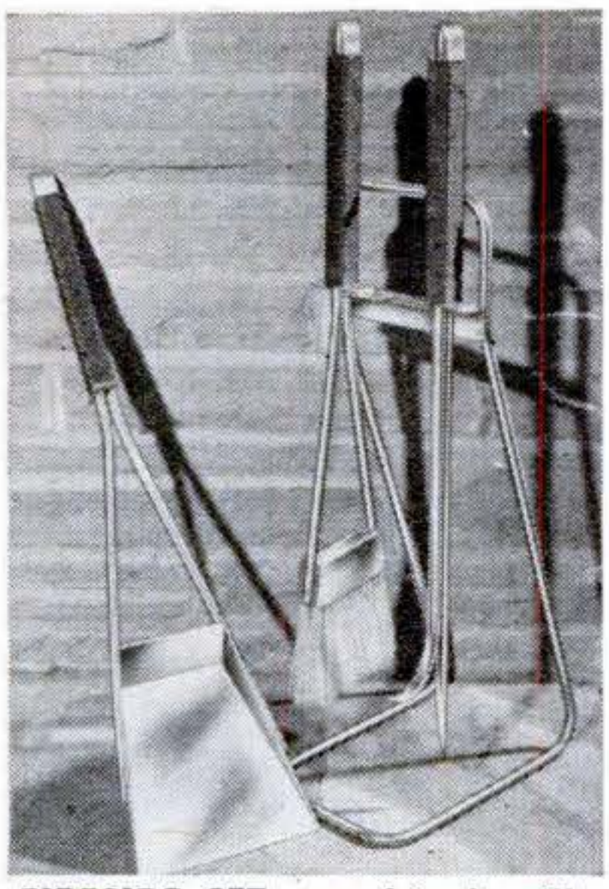
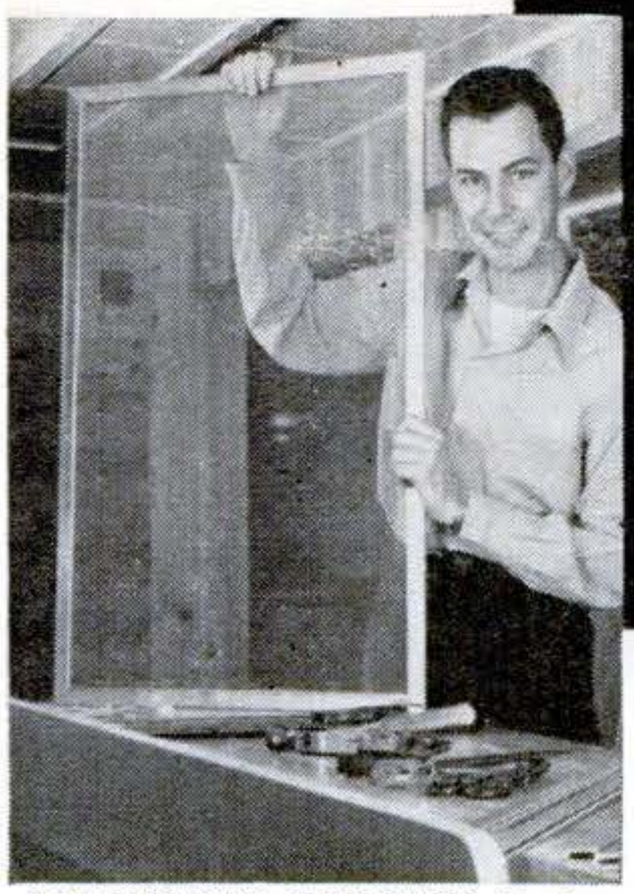
You Can Make Every Project on this page



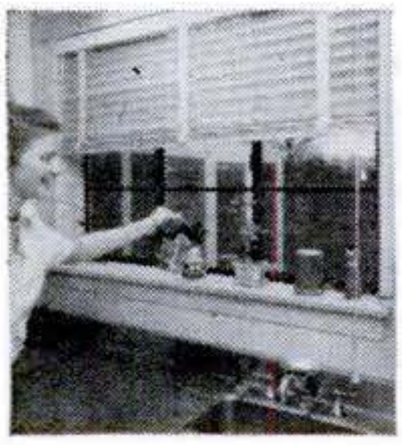
FIRESIDE SET your friends will rave over is easy fun-project for you . . . with inexpensive Reynolds *Do-It-Yourself* Aluminum. Reynolds Plan #101. See Coupon.



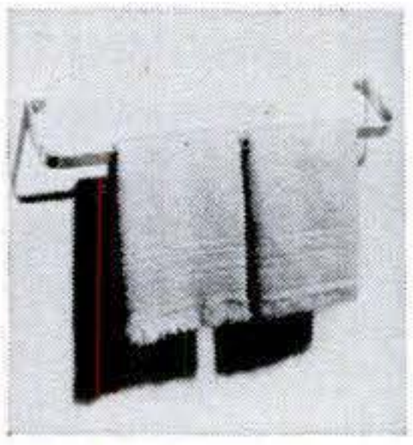
ALUMINUM SCREENS that never rust or stain are much easier to make with Reynolds *Do-It-Yourself* Aluminum than wooden ones. Free instructions. See Coupon.

TEN PLANS IN ONE

Pictured below are three of ten useful fun-projects that you'll find in one 25c Reynolds Plan (#102). See Coupon.



WINDOW SILL COVER cut from Reynolds Aluminum Sheet. Protects the wood beneath, stays sparkling-clean.



TOWEL RACK made in a jiffy from Reynolds *Do-It-Yourself* Aluminum is handy, smart . . . and won't rust ever!

RUSTPROOF RAILINGS made from this wonder-metal look like a million dollars, cost amazingly little.

LOOK FOR THIS RACK *at your hardware or building supply dealer. Ask him about Reynolds Building Products and Liquid Aluminum, the wonder-coating that's made by leading paint manufacturers.*

NO SPECIAL TOOLS *are needed to work this new material. But be sure to use only Reynolds Do-It-Yourself Aluminum with the special Seal on every piece . . . other types of aluminum may harm tools.*

...quickly, inexpensively with

REYNOLDS *DO-IT-YOURSELF** ALUMINUM

You start with a simple plan. You finish up with beautiful things for your home that would do credit to a professional craftsman. Yes, even if you're a beginner. Here's the secret. Reynolds *Do-It-Yourself* Aluminum is specially made for really astonishing workability. You can bend it, saw it, drill it, plane it, joint it and shape it, using standard woodworking hand or power tools.

Have fun . . . *and* save money!

With no previous skill you can now make hundreds of wonderful things for your home. And you'll save as much as 75% on one single project. You'll save money on *repairs,* too. Reynolds *Do-It-Yourself* Aluminum comes in plain and embossed sheets, tubing, bars, rods, angles, screen sections, handy fasteners.

*T. M. REYNOLDS METALS COMPANY

SEND FOR THESE REYNOLDS PLANS TODAY!

Reynolds Metals Company, 2493 South Third Street, Louisville 1, Kentucky

Please send me Reynolds Do-It-Yourself Plans, folders, booklets as checked below. I enclose 25c for each plan ordered.

- ☐ Reynolds Plan # 101 for FIRESIDE SET 25c
- ☐ Reynolds Plan # 102 for WINDOW SILL COVER, TOWEL RACK, HAND RAILING plus 7 other simple projects, all 10 plans for 25c
- ☐ Instruction folder for making ALUMINUM SCREENS (free)
- ☐ "How-to" booklet containing general instructions and list of suggested projects (free)

REYNOLDS DO-IT-YOURSELF ALUMINUM

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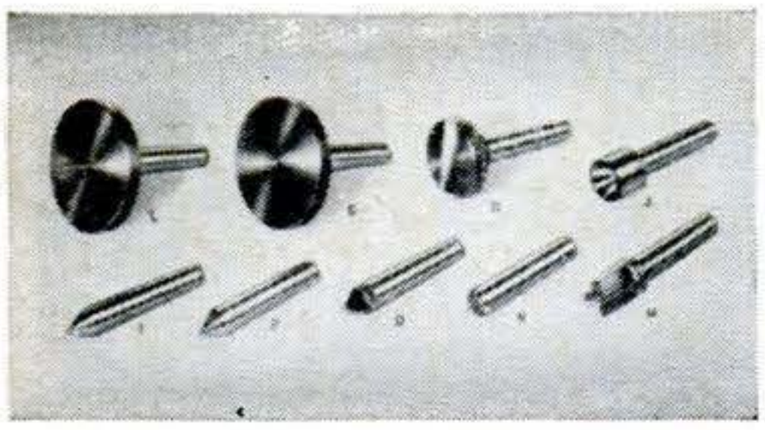
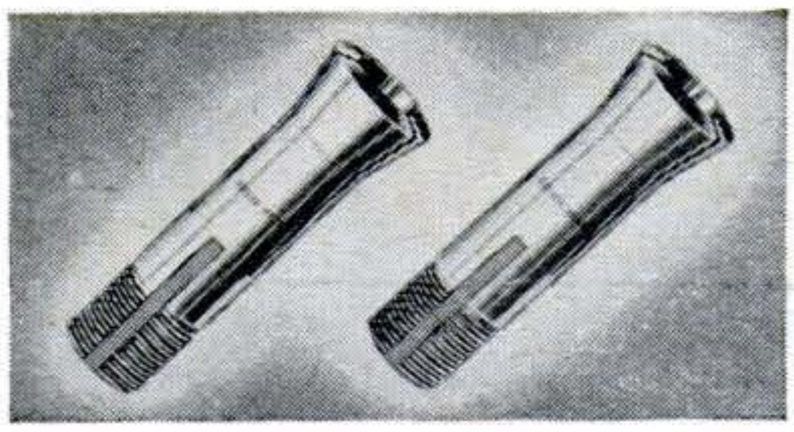
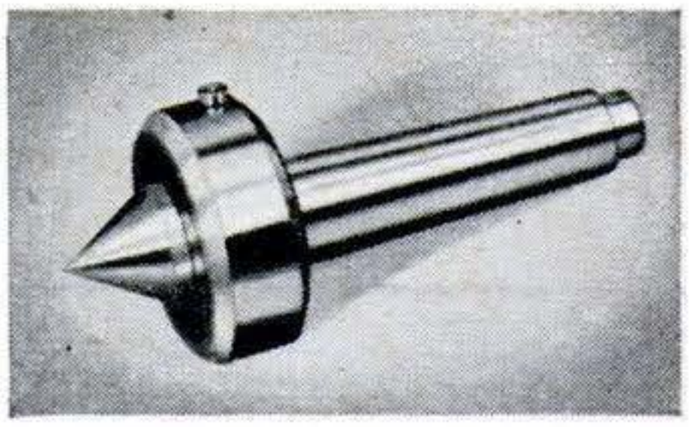


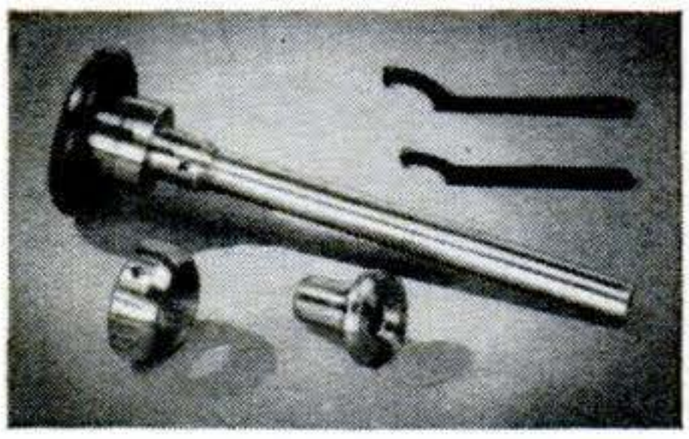
CENTERS AND DRILL PADS



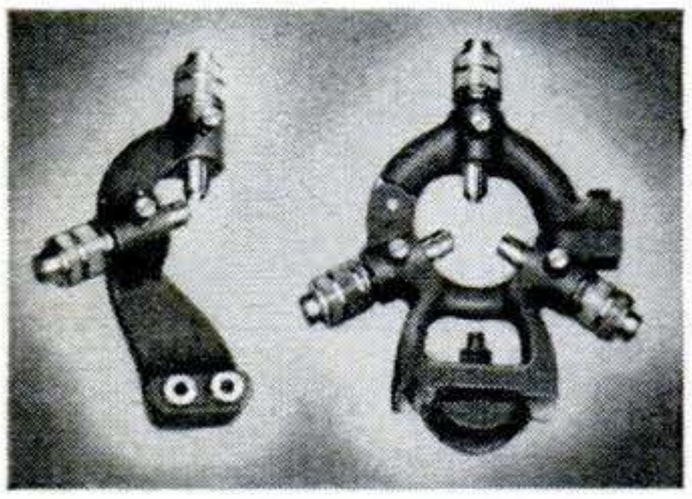
STEEL AND BRASS COLLETS



BALL BEARING LIVE CENTER



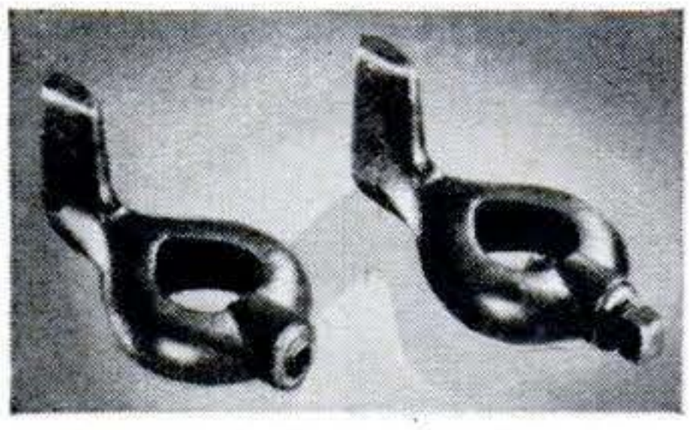
HANDWHEEL COLLET ATTACHMENT



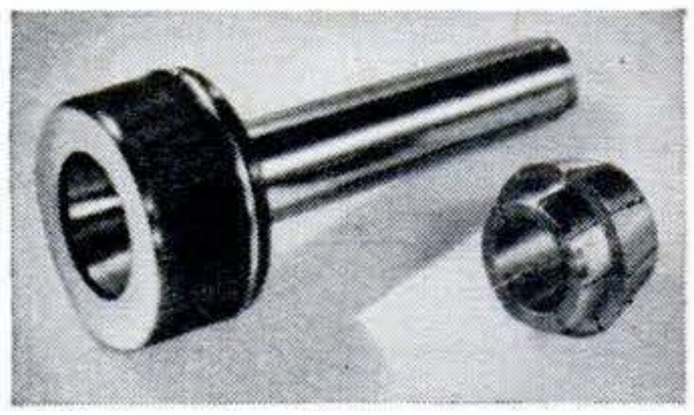
FOLLOWER AND STEADY RESTS

YOU CAN DO MORE WITH SOUTH BEND LATHES

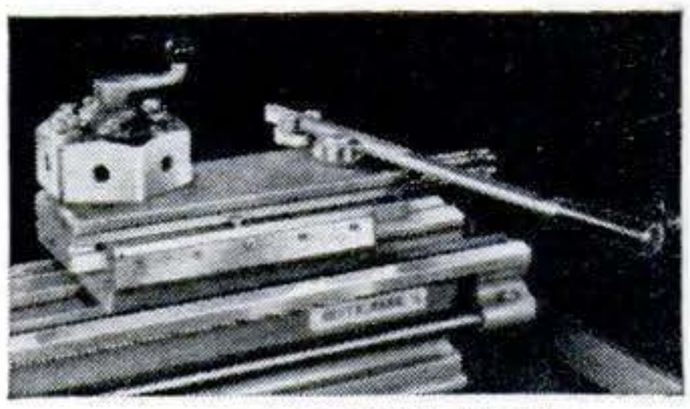
because of the very complete line of practical attachments available. Only a few are shown here. Send for complete catalog.



SAFETY and STANDARD LATHE DOGS



ADJUSTABLE COLLET BUSHING CHUCK

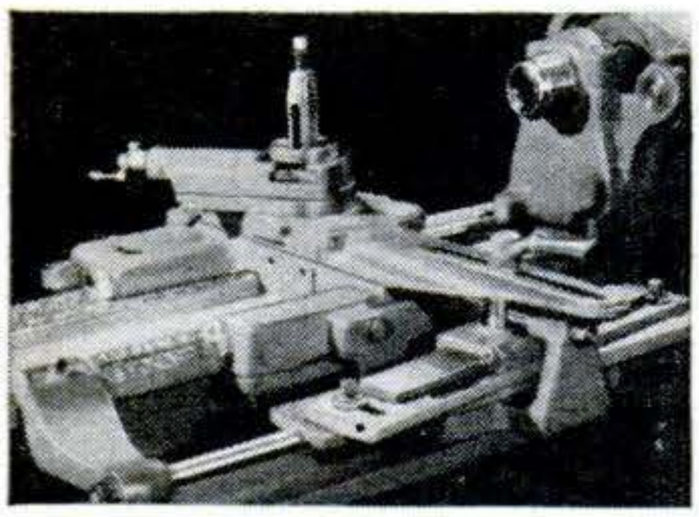


HANDLEVER BED TURRET

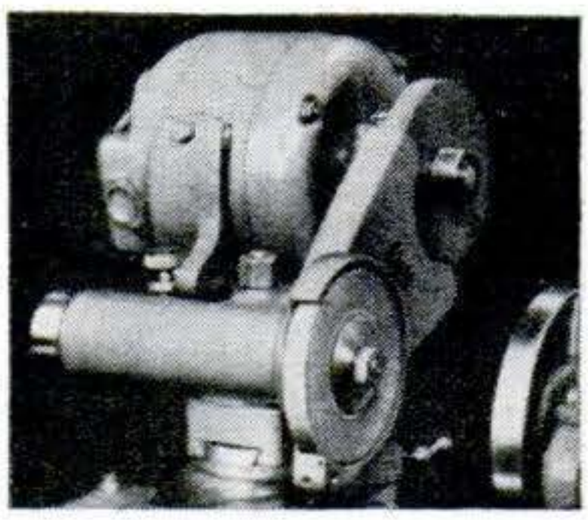
South Bend Attachments will enable you to do more and better lathe work. Write for our new Attachment Catalog.

SOUTH BEND LATHE

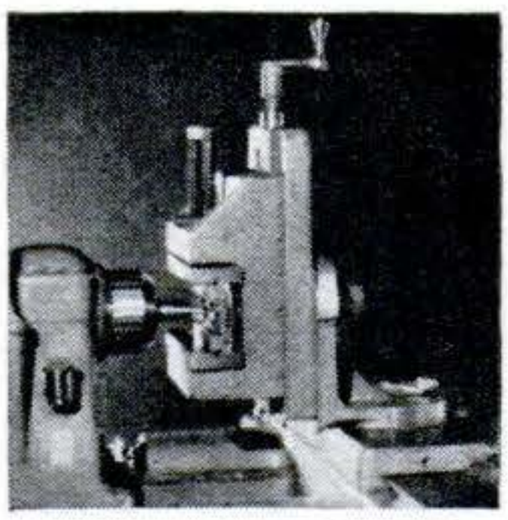
BUILDING BETTER TOOLS SINCE 1906 • SOUTH BEND 22, INDIANA



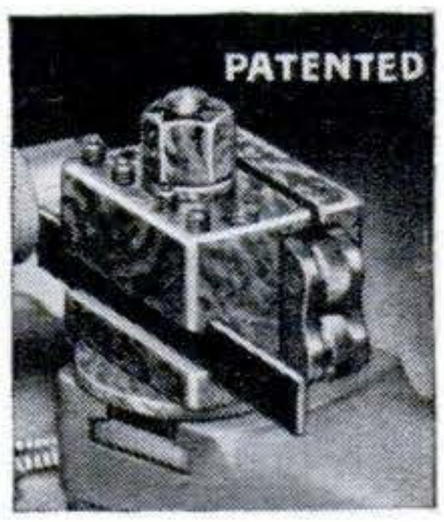
TELESCOPIC TAPER ATTACHMENT



EXTERNAL GRINDER



MILLING ATTACHMENT



10 in 1 TOOL BLOCK

Can I get it? When? How?

Yes—you can get most any South Bend product immediately from our distributor's stocks in principal cities. Items not stocked, shipped promptly from factory.

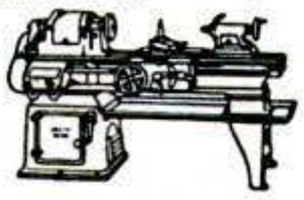
Three ways to order:

1. See or telephone nearest distributor.
2. Order by mail from your distributor.
3. If no distributor is nearby, order direct from factory.

South Bend machine tools with accessories may be purchased on convenient terms up to 18 months.

SEND INFORMATION CHECKED:

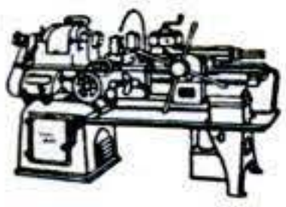
☐ 9" and 10" BENCH LATHES



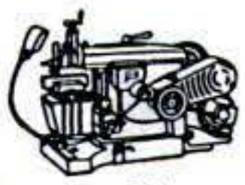
☐ 10" to 16-24" FLOOR LATHES

☐ DRILL PRESSES

☐ TOOL GRINDERS



☐ ½" & 1" Collet TURRET LATHES



☐ 7" BENCH SHAPERS

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Building Better Tools Since 1906 • SOUTH BEND LATHE • South Bend 22, Indiana

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2½ Times around the World—

61,810 miles on ONE Set of *ordinary* SPARK PLUGS

....Yet they still perform as though the engine was made for them!

Another spectacular success story for the Magna-Power Acid Neutralizer—with the porcelain insulators "shot" on three (due to accidental breakage) this set of plugs still does not misfire. The engine still idles perfectly, and smoothly—and picks up speed quickly without bucking. When new plugs were finally installed, there was no detectable difference in performance and economy.

How Is This Possible?

These plugs might even last another 60,000 miles or more. This amazing record of spark plug endurance was made possible by eliminating the corrosive acids from the engine oil!

HERE IS PROOF

These are FACTS gathered in 13 years of road tests over millions of miles in 1500 cars and trucks —NOT laboratory tests under simulated conditions.

IS IT ACID OR FRICTION?

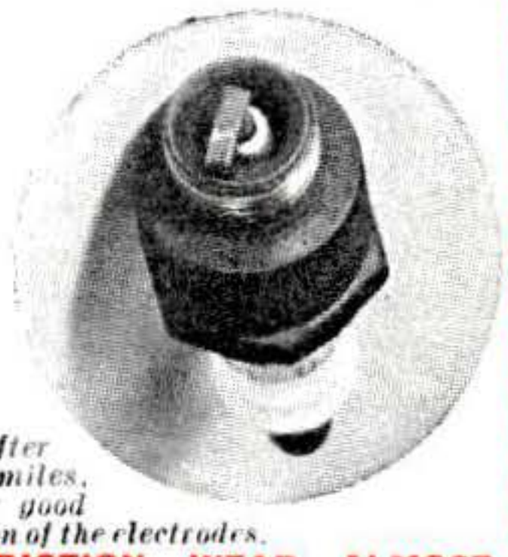
Engine friction—is negligible. Our tests show almost no metal to metal contact. Acid is the real cause of motor deterioration.

1. POWER

No engine tested decreased in power. Many have gone 120,000 miles. Top performance is yours almost indefinately—one, two, five or even ten years. Most protected engines are outlasting their bodies.

2. IGNITION

Spark plugs last up to 60,000 miles —waste less gas. The spark plug shown is from a set of 8 after 61,800 miles—the entire set still testing 93% efficient!



Actual photo after 61,810 miles, showing good condition of the electrodes.

3. FRICTION WEAR ALMOST DISAPPEARS

Fleet tests show wear reductions of almost 6 to 1 in stop and go service.

The bearing at left is from an engine with Magna-Power after 112,000 miles in 11 years. It is still good for many more years and 4 times the miles. At right, one from an unprotected engine after 63,000 miles; WORN OUT!

SULPHUR FORMS ACIDS

In 1000 gallons (enough for 15,000 to 20,000 miles) there is about 6 lbs. of sulphur—enough to make 5 gallons of strong sulphuric acid—plus bromine and chlorine. When gasoline burns, corrosive gases (SO_2 SO_3 HBr and HCl) blow by the pistons into the crankcase. Here they combine with condensed water (also blown by) to start a vicious circle. SO_3 is a thirsty compound. It absorbs water to form sulphuric acid, which in turn attracts more water, which absorbs more SO_3, which in turn attracts more water! This water body absorbs gases to form H_2CO_3, H_2SO_3, HCl and HBr—all corrosive acids. Acids cannot work without water—but your engine makes large amounts of it—about a gallon for each gallon of gas; you have seen it drip from your exhaust!

ENGINES HAVE SHORT LIFE

In door to door service they have appallingly short life. Often only 15,000 to 20,000 miles! Enough gases blow into the oil to make a pint of acid a day. Most of these go out the breather but the small amount left is enough to damage your engine seriously. Even carbonic acid, which you drink in soda pop, is powerful enough to corrode iron ⅓ inch per year.

NEW DIRECT WAY TO KILL ACIDS

Acids destroy themselves by eating metals. Acids first attack metals most easily eaten. Almost perfect protection is obtained by a special magnesium-aluminum alloy. Since magnesium is by far the most easily attacked metal in the engine, the acids eat it and are destroyed. Without acids, water is no longer held. Without water, acids cannot form. The vicious circle is interrupted. Less sludges, gums and resins are formed.

SUMMARIZING:

Normal wear, as you know it, does not exist. Manufacturer's figures are increased up to 10% in economy, speed, power. Engine wear life is increased to at least 300,000 miles by adding the Magna-Power Acid Neutralizer. Magna-Power will help any engine using less than 1 qt. of oil each 500 miles, OR YOUR MONEY BACK.

Get One Now for Your Next Oil Change — JOHNS MFG. CO., Dept. B4, Dunellen, N.J.

WHY SULPHUR IS THE REAL ENEMY OF YOUR SPARK PLUGS AS WELL AS YOUR AUTO ENGINE

Gasoline has sulphur in it. When sulphur burns it makes sulphuric acid—right inside your engine. Sulphuric acid eats metal; it destroys detergents and spawns more acid. Little by little your engine is eaten away; the spark plugs destroyed. To combat this, most oil companies are now using anti-acids. But what happens when these compounds are overcome? Your engine corrodes once more! Acid is nature's method of reducing metals to their primitive state. Most oil companies have proven acid corrosion the cause of engine wear.

Winthrop A. Johns and the original test car—says Win, "I don't expect to live long enough to wear this engine to the first overhaul! At the present rate of wear it will run at least 700,000 miles, if the parts do not break from 'fatigue.'"

HOW TO NEUTRALIZE THIS ACID

ACTION The easiest and surest way, is to use a solid chemical neutralizer attached to your oil drain plug. The Magna-Power is a drain plug with a rod of a special alloy of magnesium, by nature alkaline. Acids much prefer magnesium to other engine metals but in eating it these acids are destroyed. There is enough alloy to last at least 100,000 miles.

THIS IS A VERY SIMPLE IDEA

It was developed by a mechanical engineer after many years of trial and error, using such compounds at first as potash and magnesium shavings; none were as easy, simple or positive as this oil-drain plug device.

IT IS THOROUGHLY TESTED

Milk fleets, passenger cars, bus lines and trucking companies all have tested the Neutralizer in controlled field operations. Their enthusiastic letters are available for your inspection at any time.

YOU CAN SEE THE ACTION IN A FEW SECONDS

If you drop a Magna-Power Neutralizer into a glass of vinegar, it foams wildly. Even grapefruit juice effervesces.

EXPERIMENT WITH THE MAGNA-POWER NEUTRALIZER AT OUR RISK

If you are not satisfied send it back, at any time (years from now, if you choose), for an immediate refund.

JOHNS MFG. CO., Dept. B4, Dunellen, N.J.

My car is a.....(make).....(year). Please send me a MAGNA-POWER acid neutralizer. I enclose $2.95. I understand that it is sold with an unconditional guarantee of satisfaction or my money back!

Name.....

Street.....

City.....State.....

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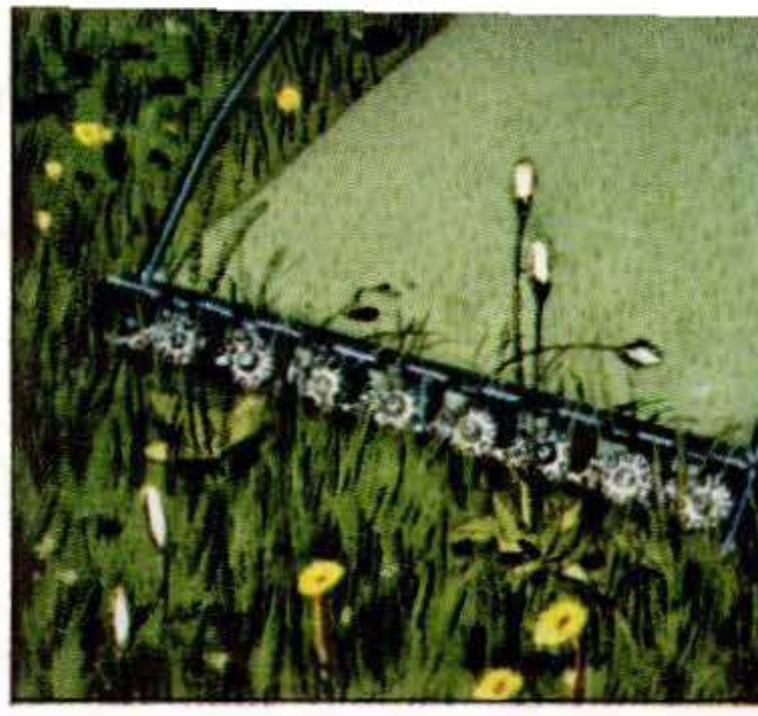
You can do the whole job with a MONTAMOWER



The MontaMower smoothly cuts a full 16″ swath of grass, cleanly cutting all the dandelions and tall lawn weeds which the reel-type mower leaves standing . . . no more going back over the lawn with a whipper!

The MontaMower eliminates back-breaking hand trimming. Unlike the conventional mower, it is actually two tools in one . . . mower and trimmer!

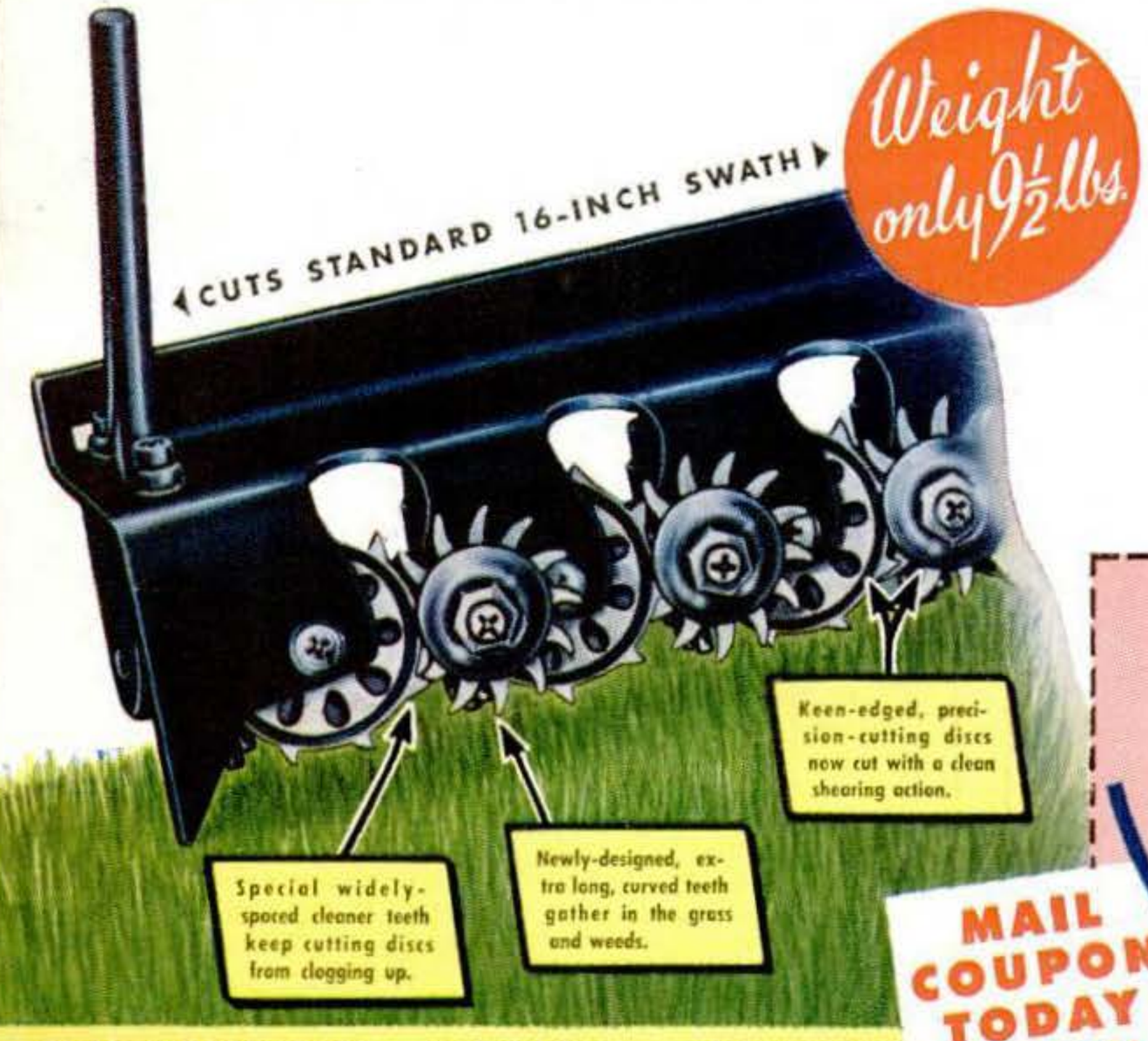
The MontaMower "Trims-as-it-cuts" right up close to fences, trees, buildings, walks, shrubs, flower gardens and cement walls.

The MontaMower is so light that even women and teenagers can mow steep terrace banks, up, down, or across, with scarcely any effort!

ONLY MONTAMOWER TRIMS as it MOWS — IN ONE EASY OPERATION

The versatile MontaMower is actually "Two-Tools-In-One" . . . an efficient lawn mower and a very fast lawn trimmer. Due to its unique patented design it is the only machine that does the *whole job* of lawn cutting and trimming in one easy operation. Its live, precision mechanism first gathers, then smoothly cuts a clean 16″ swath through grass, dandelions and tall lawn weeds as evenly as a pair of keen-edged shears. It cuts right up to trees, walls, fences and borders . . . "Trimming-As-It-Cuts" . . . leaving practically no back-breaking, time-consuming work to be done by hand. Enthusiastic owners throughout the world tell us the MontaMower is the most practical hand lawn mower ever designed! Even power mower users say it's a "Must" for close-quarter mowing and all the trimming! Fast, efficient and weighing only 9½ lbs., you'll find it's the most wonderful work-saver and time-saver you've ever had for lawn care.

HERE'S HOW IT WORKS Eight pairs of newly designed, Self-Cleaning and Self-Sharpening, precision made and fitted, tool steel cutting discs revolving toward each other gather the grass and cut it cleanly with a new shearing action. Newly designed handle with comfortable form-fitting rubber grips is easily adjustable to change cutting height of grass. The MontaMower's drive shaft, with factory sealed bearings, is permanently lubricated to assure *smooth, trouble free* performance and long life. (Hundreds of thousands in world-wide use.) SOLD WITH OUR WRITTEN GUARANTEE!



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TRY THE VERSATILE MONTAMOWER ON YOUR OWN LAWN . . . ON APPROVAL!

An actual trial on the lawn where it is to be used is the most convincing proof of the exclusive advantages of a MontaMower and its superiority to conventional mowers. We have, therefore, developed a most attractive "TRY IT ON YOUR OWN LAWN ON APPROVAL OFFER" for those who are definitely in the market for lawn mowing equipment of one type or another. Don't miss this opportunity to see for yourself how invaluable the MONTAMOWER would be to you! Act NOW! Fill out the coupon below . . . Mail it today!

WRITE FOR DETAILS OF OUR ATTRACTIVE TRIAL OFFER

MAIL COUPON TODAY PASTE ON

MontaMower Distributing Co., Sales and General Offices
PS-44 KEELER BLDG., GRAND RAPIDS 2, MICHIGAN

Gentlemen: Kindly send me (FREE OF CHARGE) completely illustrated, descriptive literature, price, guarantee information, and full details of your attractive "TRY IT ON YOUR OWN LAWN ON APPROVAL OFFER."

FREE

NAME _____

ADDRESS _____

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